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SURGERY, GYNECOLOGY AND OBSTETRICS

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ROENTGEN-RAY DIAGNOSIS OF GAS AND PUS INFECTIONS AS COMPLICATIONS OF WOUNDS WITH DEEPLY BURIED BULLETS OR SHELL FRAGMENTS

BY GEORGE G. DAVIS, A.B., M.D., CHICAGO

Operating Surgeon, Twenty-Third General Hospital, British Expeditionary Force, Etaples, France

IT is a routine procedure at the Twenty-third General Hospital to roentgen ray all bullet or shell wounds, when the missile is suspected of remaining in the body. Also it is our custom to have two views; an anteroposterior and a lateral, before starting any surgical interference aiming to remove the foreign body.

As a large percentage of our cases are bullet or shell injuries, we have an excellent opportunity of studying and drawing conclusions from our roentgen-ray findings.

In all cases in which the roentgen ray has shown a "halo-like" shadow about the missile, we have found clinically, at the operating table and in the laboratory, evidence of an infection caused by gas- and pus-forming organisms.

The roentgen-ray pictures of these cases may best be described by dividing them into two groups: In the first the gas and pus infection is local or limited and a single "halo-like" shadow is noted about the bullet, sometimes encircling it like a halo, or more often extending in one or more directions from it, either above or below or laterally (Fig. 3). This shadow may have a diameter of half an inch or as large as two inches. The local picture may be composed of a number of small, irregularly round or elongated shadow areas (Figs. 4 and 5) in close relation to the bullet or extending along the track of the missile.

The roentgen-ray picture in the second group of cases, that is in those cases in which the gas and pus infection is more or less extensive, shows a shadow similar to that noted in the first group, plus shadows extending upward and downward for a considerable distance (Figs. 1 and 2), according to the extent of the infection.

Clinically these cases early manifest definite symptoms. The patient complains of severe pain in the region of the missile. He feels sick, weak, and is very restless. There is a marked rise in temperature and increase in the pulse-rate. Locally one finds a swelling, which may be confined to the area about the missile, or in the more severe or extensive cases, the entire diameter of the limb may be increased and indurated. A point of exquisite tenderness will at times help the operator to localize the missile. On palpation with moderate pressure, a crackling sensation—crepitation—is imparted to the examining hand and gas bubbles may be seen to escape through pus at the wound of entrance of the missile.

At operation, one finds along the entrance wound and about the missile, a generous pocket of thick pus, which has a pinkish color and gives a characteristic gas odor. This pus may be localized about the missile or in the

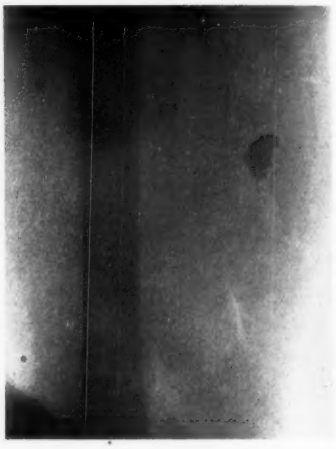


Fig. 1. Showing a "halo-like" shadow of gas about a fragment of shell; also longitudinal shadows of gas in the intermuscular planes. This patient died of gas bacillus infection.

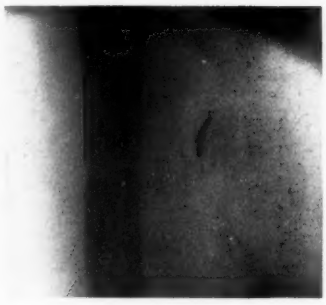


Fig. 2. Same case as Fig. 1 showing shell fragment and longitudinal shadows of gas in the intermuscular planes. This patient died of gas bacillus infection (bacillus aerogenes capsulatus).

more severe cases extend up along the intermuscular planes.

The laboratory examination of the pus shows in about 95 per cent of the cases the

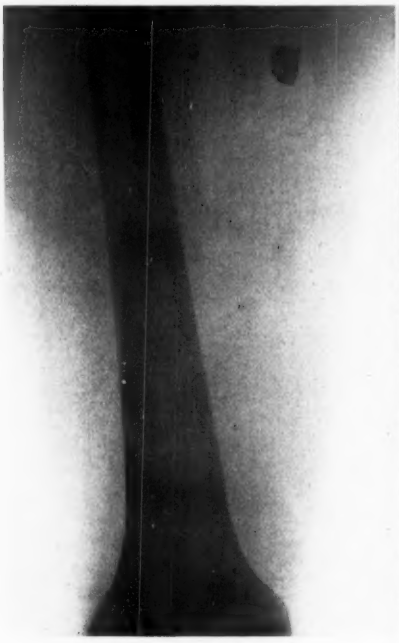


Fig. 3.

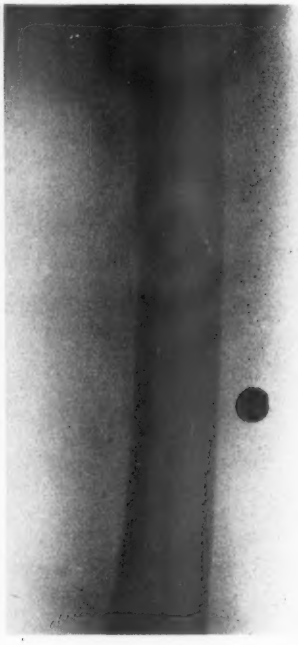


Fig. 4.

Fig. 5.

Fig. 3. Showing "halo-like" shadow of gas and pus about the fragment of shell. The shadow here is mostly below the missile.

Fig. 4. Showing a number of small irregularly round or elongated shadows of gas and pus above and anterior to shrapnel bullet.

Fig. 5. Showing a number of small irregularly round or elongated shadows of gas and pus anterior to a fragment.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 6. Showing a serpent-like shadow of gas, which extends above and below a fragment of shell.

Fig. 7. Showing shell fragments and extensive gas infiltration between muscle-bundles, especially about the lower third of femur. The infection involved also the upper third of the thigh and extended to the abdomen. The patient died 48 hours after injury.

Fig. 8. Same patient as in Fig. 7 showing gas infiltration in upper third of thigh, especially on lateral aspect. Patient died 48 hours after injury.

bacillus aerogenes capsulatus, with accompanying pus organisms. Of the latter, the staphylococcus is the most frequent. Other associated organisms are the streptococcus pyogenes, colon bacillus, tetanus bacillus. The colon bacillus is especially common in wounds about the buttocks. The tetanus bacillus is at times found in the pocket of pus, but clinical symptoms of tetanus do not follow.

We have found the roentgen-ray picture here described so constantly in cases which give this same clinical, laboratory, and operating-room finding, that we believe it to be of considerable value and importance.

In cases where the missile has been allowed to remain in the body and clinical symptoms develop, we request a roentgen organ to see if this finding has developed. If this picture is encountered when raying to locate a missile, we consider it an indication for urgent surgical interference.

FRACTURE OF THE OS CALCIS

By BENJAMIN F. LOUNSBURY, M.D., Chicago

THE subject of fracture of the os calcis might well be discussed under the title of unrecognized and neglected fractures. During the past four years 21 cases of fracture of the os calcis have come to me, most of them incorrectly diagnosed. Interest in these cases led me to review the literature and acquire other data from unpublished sources. In this latter connection I am indebted to Dr. Hollis E. Potter for the privilege of seeing his collection of more than one hundred radiograms of fractured os calcis, gathered during his long experience as radiographer of Cook County Hospital, the Presbyterian Hospital, and from other sources. Through his courtesy I am using some of his radiograms to help illustrate this article.

Until a comparatively recent date, fracture of the os calcis was considered a rare condition. The growing practice among surgeons of submitting all doubtful injuries to the X-ray, has shown that many conditions about the foot and ankle at first looked upon as sprains, were in reality, fractures. This has been especially true with reference to the calcaneum. One author[1] estimates that fractures of this bone form 2 per cent of all fractures, and that in 75 per cent of the cases reviewed by him, the first diagnosis was wrong. Von Bergmann quotes Ehret as claiming that 2 per cent of all fractures are of the os calcis, and quotes Golebiewski as claiming that they form 4 per cent of all accident cases. Out of one thousand cases of fracture which I have treated in the past four years, 21, or 2.1 per cent were fractures of the os calcis. Five cases have come to my care within the past five months; 2 immediately following injury and 3 that had been treated for some time as sprained ankles. It is because of the unusual disabling after-effects and the errors in diagnosis that greater care should be exercised in examinations of injury of the foot and ankle and a better plan of treatment instituted when once the condition is known.

The mechanical forces concerned in these fractures vary with the pathological conditions produced. Architecturally, the calcaneum is constructed much like a cantilever bridge, the tuberosity and the cuboid articulation being the points of support. The intervening space is spanned with filaments of bone so arched as to give the maximum carrying strength. This structure is shown in Fig. 1, which represents a normal condition. The astragalus which is a much denser bone than the calcaneum, articulates with the latter by a convex, concave articulation. The part of the astragulus which articulates in the concave facet of the calcaneum, fits into it like a wedge with the apex pointing downward directly beneath and in line with the shaft of the tibia. (a) As the great majority of fractures are produced by falling from a height, landing on the feet, there is a tendency for this harder wedge-like portion of the astragalus to drive through the calcaneum at this point, especially if the foot be everted when landing. The resistence of the object on which the foot lands tends to drive the posterior fragment upward and backward. (b) The bone may be fractured by muscular strain as reported by Raymond Spear[2] in which the contraction of the muscles of the calf pulled off the tuberosity and drew it upward and backward with the Achilles tendon. (c) A smaller percentage of fractures result from crushing between two opposing forces as is sometimes seen in elevator accidents, when the foot is caught between the floor of the elevator and the shaft, or when heavy wheels pass over the foot. (d) In most of the injuries there is probably a combination of compression and muscular strain. In Fig. 5 it would seem that the plantar fascia and muscles arising from the calcaneum, had combined with the force of the falling body to fracture the tubercle and pull it forward. There is great variation in the pathological conditions found; usually more than one line of fracture exists.

[1] Leonard W. Ely Ann. Surg., Phila., 1907, January.

[2] U. S. Navy Med. Bull., 1910, iv, 383.

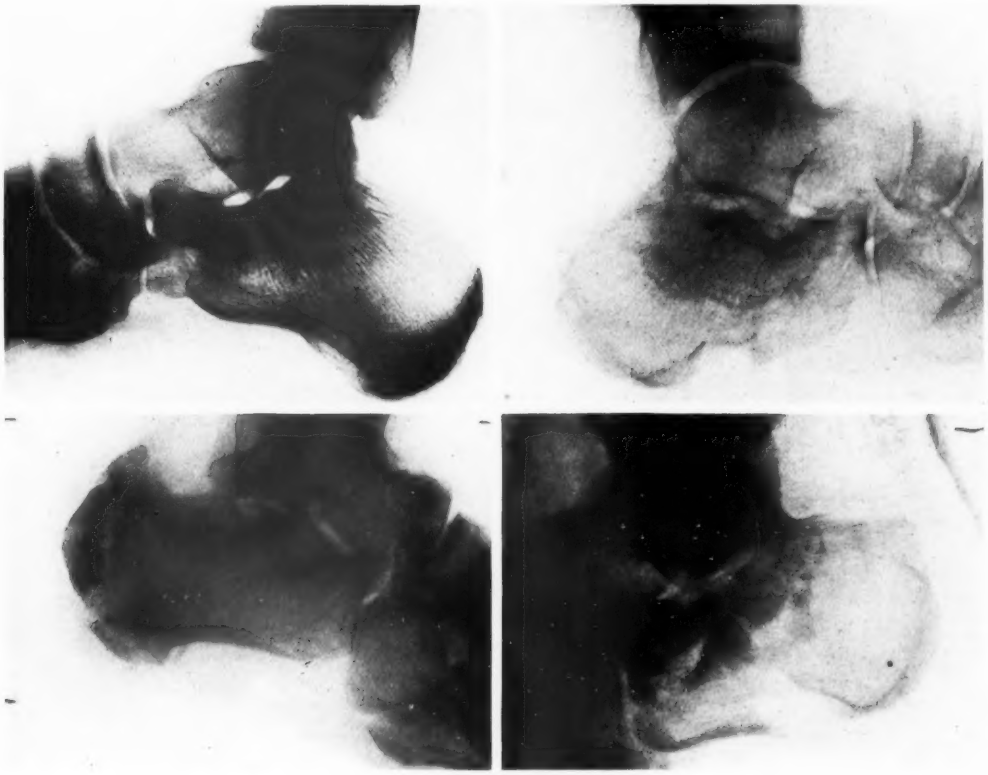


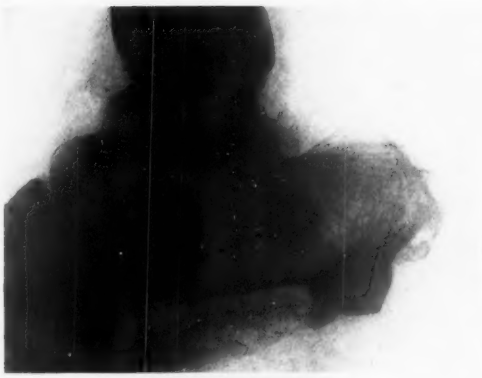
Fig. 1.
Fig. 3.

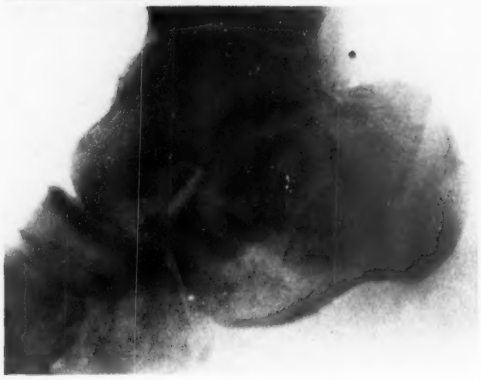
Fig. 2.
Fig. 4.

1. In the great majority the main line of fracture is through the concave facet beneath the wedge-like convex facet of the astragalus. From this point there may be one or several lines of fracture, vertical or longitudinal, or obliquely backward. The mass of bone posterior to this point is usually driven upward and backward (see Fig. 4).

2. Frequently the main line of fracture runs vertically from just in front of the tuberosity beneath, to a point just behind the posterior border of the convex astragalus articulation, with displacement upward of the posterior fragment (see Figs. 6, 7, and 9). The sustentaculum tali may be fractured by a sudden inversion of the heel the line of cleavage being in a vertical plane which passes through the longitudinal axes of the calcaneum at the point where the sustentaculum tali begins to project from the medial surface. Such condition is shown in Fig. 15.

3. Of less frequent occurrence is the tear fracture. This occurs from muscular and tendon strain resulting in the tearing off of a portion or all of the tuberosity, or a chip from lateral surface. It may result from contraction of the calf muscles in which instance a portion of the bone and the attachment of the Achilles tendon are drawn upward (see Fig. 3). It may result from strain of the plantar fascia and muscles, tearing off and displacing forward the portion of the tuberosity to which they are attached (see Fig. 5); or it may result from strain on the calcaneofibular ligament with tearing off of a portion of the lateral surface of the calcaneus.





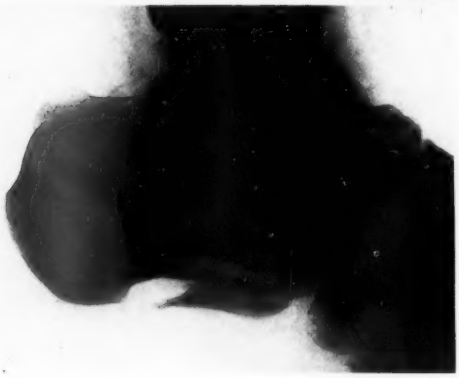


Fig. 5.
Fig. 7.

Fig. 6.
Fig. 8.

4. There may be a combination of two or more of these types resulting in comminution of the bone (see Figs. 2 and 14).

5. Any of these forms may be compound. In recent cases there is usually considerable damage to the soft parts resulting in hæmatoma and ecchymosis. In any of the types of fracture enumerated there may be marked or very slight displacement of the fragments, or in some instances, fracture without displacement (see Fig. 13). In most cases impaction to a greater or less extent exists.

In discussing signs and symptoms it is necessary to consider them from the standpoint of recent and old injuries. In recent cases the patient usually presents a swollen, discolored heel and ankle. Depending on the violence of the injury there may or may not be broadening of the heel, flattening of the longitudinal arch of the foot, sinking of the malleoli, eversion of the heel, loss of concavity on each side of the tendon Achilles and crepitation on manipulation. Pain is the chief complaint and this is aggravated by attempt to stand on the foot, or by manipulation. In old cases the patient complains of pain in the instep, under the heel, or under the external maleolus. The foot usually shows a flattening of the longitudinal arch, broadening and eversion of the heel, loss of concavity on both sides of the tendon Achilles, sinking of the melleoli, especially the internal one which is unusually prominent.

The diagnosis without a radiogram, is difficult, especially in recent cases. Ehret's statistics quoted by Von Bergemann, show that out of 47 cases, only 3 were correctly diagnosed. Other statistics show practically no better

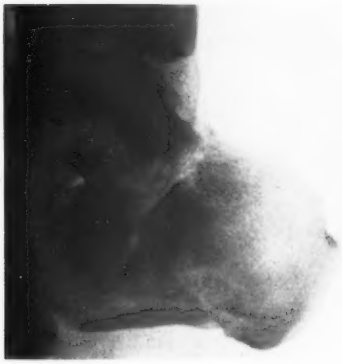


Fig. 9.

Fig. 10.

results. Before the general use of the X-ray in injuries, there was justification for these errors, but today mistaken diagnosis should be the exception. Without a radiogram one can hardly be sure of conditions in any case. With the radiogram all doubt is eliminated. The differential diagnosis lies between fracture of the os calcis and other injury about the ankle, and here again the radiogram is the court of last appeal, and judging from past experiences it would have been better for the patient had it been the first. It not only makes the diagnosis as to the presence of fracture, but gives us the only reliable information on which to select proper treatment.

Treatment of these conditions, if we may judge by results, has in the past been very unsatisfactory, either through lack of early diagnosis, or because of inadequate management. Cabot and Binney[1] reviewing 111 cases in the Massachusetts General Hospital admitted over a period of fifteen years, say that results thus far in treatment, are not good. Ely[2] reviewing seventeen cases says results with the usual treatment, are bad. I have heard the remark that about all that can be done for a fractured heel, is to make a diagnosis and a bad prognosis. When we consider that in most cases the true conditions are not known until healing with some permanent disability has occurred (see Figs. 10 and 14), the importance of early diagnosis as a prophylactic measure becomes evident.

[1] Ann. Surg., Phila., 1907, xlv, 51.
[2] Leonard W. Ely. Ann. Surg., Phila., 1907, January.

Because of the great number of neglected cases, treatment must be considered from the standpoint of old and recent injuries. Treatment must be adapted to the different conditions presented. In tear fractures, suture with kangaroo tendon followed by immobilization with relaxation of the muscles of the calf and the plantar fascia and muscles. A great majority of recent injuries present a fracture with displacement backward and upward of the posterior portion attached to the Achilles tendon. In many instances considerable impaction has taken place. This results in flattening of the longitudinal arch of the foot. The fragment is held in malposition by contraction of the calf muscles and the impaction. The ordinary practice of trying to manipulate this fragment into position has failed in every instance in which I have tried it. Following Cabot's suggestion I have been able to secure reduction by passing a urethral sound above the fragment in front of the Achilles tendon and making downward traction while an assistant makes counter force on the anterior end of the bone, by pulling up under the instep with a piece of gas pipe placed transversely to the longitudinal arch. This generally gives excellent reduction. The Achilles tendon is then severed to overcome the pull of the calf muscles and the heel and ball of the foot drawn toward the center, elevating the arch. A plaster cast extending to the knee and elevated in the arch, is then applied. While the cast is hardening, pressure

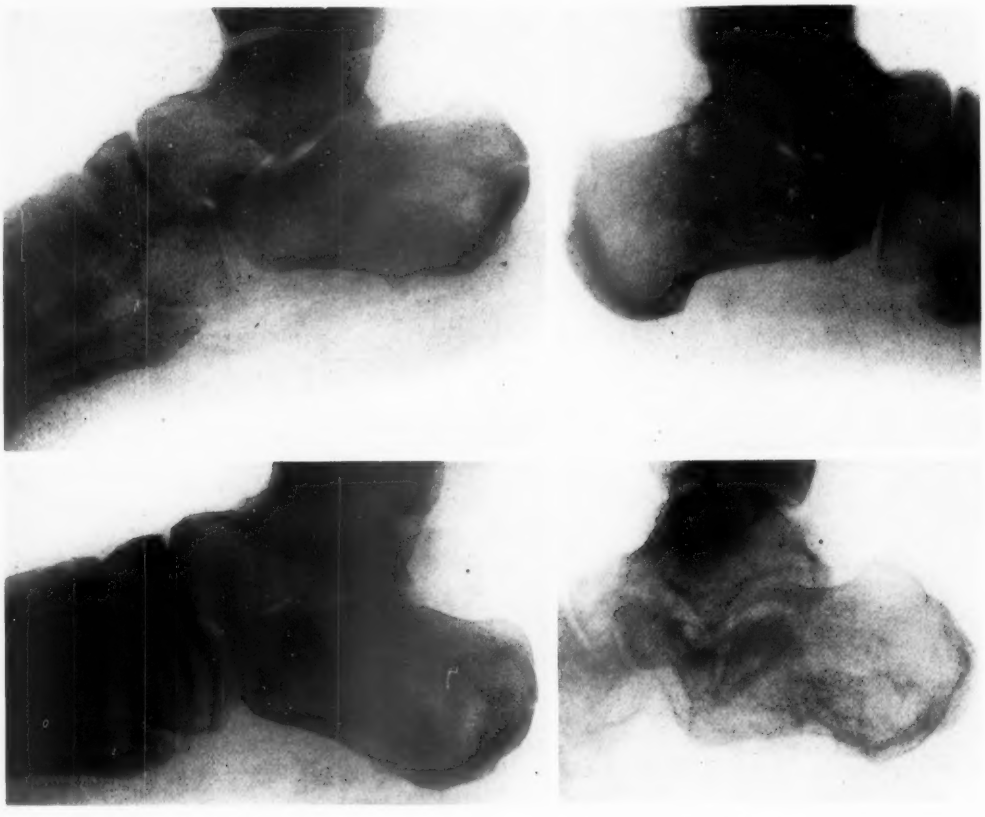


Fig. 11.
Fig. 12.

Fig. 13.
Fig. 14.

is made upward in the arch and the cast is indented laterally above the posterior fragment. This cast is left on for about four weeks and then removed and passive motion, massage, and hot foot soaks given daily. The patient is not allowed to put any weight on the feet for ten weeks. He is then fitted with arch support and begins by the aid of crutches to gradually put weight on the foot.

Figures 11 and 12 show a case treated in this manner. The patient was seen within an hour of the accident, both heels had been fractured by a fall of about twenty-feet landing on a concrete pavement. Radiograms showed the condition seen in Fig. 11. Under general anæsthesia, reduction was attempted by manipulation. Failing in this the patient was put to bed with ice packs about the ankle. Four days later when swelling had somewhat subsided, a general anæsthetic was given and the treatment as above outlined, carried out. Figure 12 shows the end-result. We have applied this method in three cases with good anatomical and functional results.

Von Bergemann in discussing treatment, says, "If the fragment cannot be held in place with a splint, it should be nailed in place through the skin, as recommended by Gussenbauer." Such treatment seems objectionable for two reasons: First, the danger of necrosis and infection owing to the poor blood supply to the heel (this was recognized even in the time of Hypochrates who described fracture of the os calcis and cautioned that if improperly

treated might result in gangrene). Second, mechanically, great strain is put on the single line where bone contacts with the nail, and pressure necrosis with ultimate displacement of the fragment is likely to result. In greatly comminuted fractures with lateral broadening, Cotton[1] recommends re-impaction with a mallet by hammering the fragments together from the lateral aspect.

In compound and comminuted fractures it is sometimes necessary to remove some of the fragments. Leriche[2] reports a comminuted fracture in which he resected the greater portion of the bone and says that he obtained excellent functional results. Eisendrath[3] reports a case in which the posterior tip with the tendon attachment was torn off. This he treated by suture. In old cases which constitute the large majority of patients, the surgeon is consulted to obtain relief from disabling pain. The pain is usually under the external malleolus, in the instep, under the point of the heel, or in the sole of the foot. Frequently a proper fitting arch support will relieve the pain in the instep, which is due to flattening of the longitudinal arch. For pain in the sole of the foot, Cotton[4] recommends a pad under the heel, thus lifting pressure from structures in the sole of the foot. Pain under the external malleolus is due to broadening of the os calcis from displaced fragments or callus. This can be relieved only by chiseling away the impinging portion of the os calcis. Pain under the heel is caused by callus or misplaced fragments of bone which should be removed (Figs. 4, 5, and 8). To restore the normal contour of the plantar surface and bring the posterior end of the os calcis down, Gleich has recommended an operation in which a wedge-shaped piece of bone is removed from the under surface, thus bringing the posterior end downward and forward.

The prognosis from most accounts in the literature is bad. Von Bergemann says: "If the fragment cannot be properly reduced the functional disturbance is usually permanent; the patient complains of pain in the sole

[1] Dislocations and Joint Fractures. 1910.
[2] Leriche. Lyon méd., 1913, cxxx, 1185.
[3] Ann. Surg., Phila., 1915, xli, 363.
[4] Dislocations and Joint Fractures. 1910.

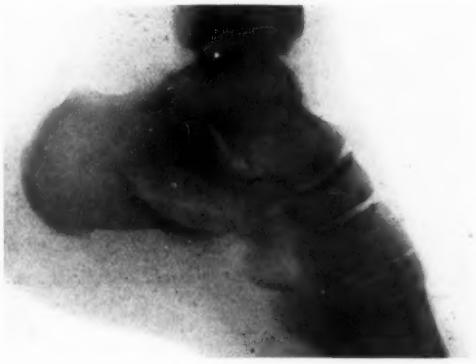


Fig. 15.

of the foot, the extensor muscles atrophy, and hard work is impossible." Cabot and Binney estimate average disability at from six months to two years. It must be remembered that these opinions are based on conditions that existed as far back as fifteen and twenty years ago, when radiograms were not so generally used as they are today. It would seem with the better facilities for diagnosis and better methods for treatment, that we might hope for great improvement in the results in the future.

Responsibility for the majority of bad results is largely chargeable to lack of thoroughness in examination of foot and ankle injuries and, more than anything else, to neglect of the radiogram and to inadequate methods of treatment when the condition is recognized.

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THE ORIGIN OF HYPERNEPHROMA OF THE KIDNEY[1]

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In view of the confusion and doubt still existing in regard to the nature and origin of the so-called hypernephromata of the kidney, I feel justified in reporting the results of a study of 34 of these tumors made with the purpose of finding evidence pointing to a definite origin. The tumors studied were collected from this and the Bellevue Hospital pathological laboratories and show, without exception, macroscopic and microscopic features that have justified the diagnosis of "hypernephroma." There is nothing special about the method of study except, perhaps, that emphasis was laid on a thorough search of the respective clinical histories and autopsy records for the presence of sex abnormalities, and on a close comparative study of the different histological features of each tumor with the view of determining its primary structure as distinguished from appearances due to secondary degenerative or malignant changes. The latter object was accomplished by the tedious labor of making innumerable frozen sections from practically all parts of each tumor, the frozen-section method having been adopted in order to make possible the use of universal fat stains.

The theories of origin of renal hypernephromata have been discussed so fully in recent publications (1) that it is unnecessary to review them in detail. It is sufficient to state that the theory formulated by Grawitz (2) that they develop from adrenal rests in the capsule of the kidney still prevails in textbook teaching and with probably the majority of clinicians and pathologists. The conclusions reached by nearly all writers who have studied the question at first hand agree, however, with the hypothesis first formulated by Sudeck (3), and later supported by Stoerk, namely that they are of renal origin, though there is a difference of opinion among these authors as to the particular structure of the kidney from which they arise.

As I have kept constantly in view in determining evidence as to tumor origin the traditional arguments for and against each of these theories, it may be well for the sake of clearness to restate them briefly:

1. *The "adrenal rest" origin.* The chief argument for this hypothesis is found in the striking resemblance of the tumor-cells to those of the adrenal cortex together with their difference from those of the renal tubules. The fact that the position of the tumor—usually immediately beneath the renal capsule—corresponds with that of "supposed" adrenal rests, though formerly cited in support of the theory is now regarded as of little if any significance.

Against this hypothesis the chief facts are:

a. The difference, histologically, between epithelial tumors of the adrenal cortex and hypernephromata of the kidney. In the former the highly reticulated character of the cells as well as tubular and papillary formations is absent, the very few so-called exceptions recorded being of doubtful character.

b. Clinical differences between adrenal and renal hypernephromata. First, as to age of incidence, adrenal hypernephromata occur nearly always in the young, while hypernephroma of the kidney is found in adults with increasing frequency after the age of 35 years. Second, sex abnormalities constitute a usual accompaniment of adrenal hypernephroma whereas, up to the present time, no symptoms of this nature have been described in connection with hypernephroma of the kidney.

c. The frequency of hypernephroma of the kidney when compared with the rarity of true adrenal rests in the kidney.

2. *The renal origin theory.*

a. It is claimed that it would be a strange anomaly were the most common primary neoplasm of the kidney of foreign origin.

b. It has been shown by Stoerk, Zehbe (4), and others that renal tubules under certain conditions grow in solid columns and that

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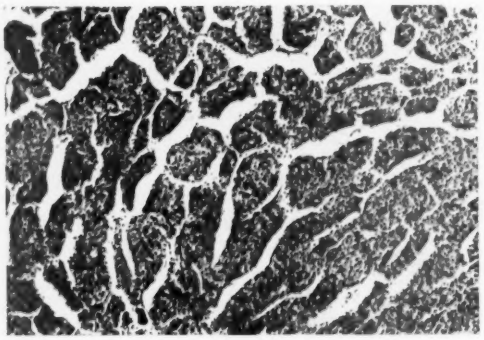

Fig. 1. Microphotograph (low power) of Case 1, Group 1.

the cells are capable of developing the "hypernephroid" character.

c. It is further claimed that the papillary and cystic formations so frequently seen in renal hypernephromata could only arise from a structure that is fundamentally tubular—in this instance, the kidney.

d. It is claimed by Stoerk that the hypernephroma-cells possess characters as to appearance and cell contents that are foreign

Fig. 3. Microphotograph (low power) of a tumor nodule growing from the nest of adrenal composite situated on the inner surface of the kidney midway between the upper pole and the hilus. The dark columns at the top represent well preserved cordons of adrenal cortical cells, appearing black in the picture because of the presence of pigment. (Case 2, Group 1.)

Fig. 2. High power drawing of Fig. 1.

to the adrenal but which, under certain conditions, are found in the cells of the uriniferous tubules.

The tumors in our collection can be divided into two general groups: those which show positive evidence of being neoplasms of either misplaced or accessory adrenal tissue, and those which show decided evidence of renal origin.

GROUP I—ADRENAL ORIGIN

In this group there are two tumors which, on account of certain specially interesting features, will be described in detail.

CASE I. This tumor was removed surgically by Dr. George D. Stewart from whose records I

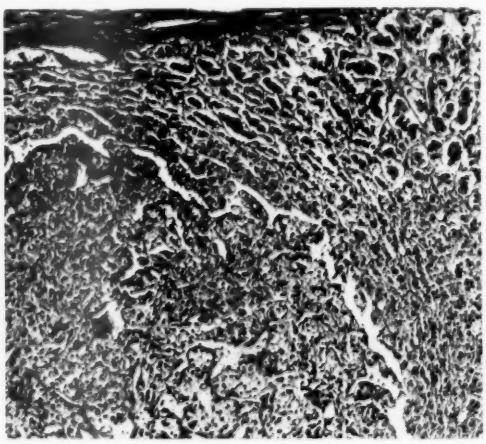

Fig. 4. Tumor nodule growing from aberrant adrenal cortical tissue at the upper pole of the kidney. (Case 2, Group 1.) Shows normal adrenal cortex above and tumor nodule below and to the left. (Low power.)

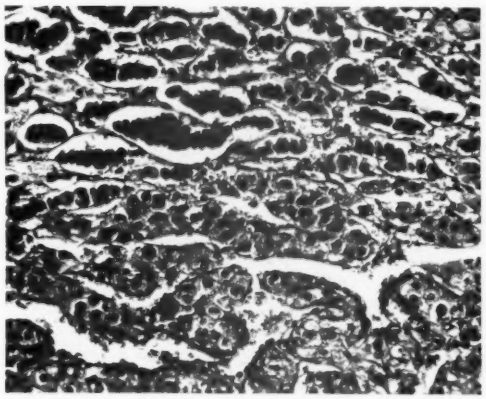

Fig. 5. High power of Fig. 4, showing gradual transition from normal adrenal columns above into tumor cordons below.

select the following data: The patient was a white female, aged 28 years, and single. She was 6 feet in height and of excellently developed musculature. The hair on the head was thick and coarse. On the face, chest, arms and legs there was a thick growth of coarse black hair, that on the upper lip amounting to a small moustache. The mammæ were underdeveloped and the chest as a whole was decidedly of the male type. Menstruation was regular. The patient had had a "weak" stomach since childhood, with frequent attacks of indigestion accompanied by violent headaches. No urinary findings or symptoms referable to the kidneys are mentioned. The patient was under treatment for "indigestion" when a movable mass in the false pelvis was discovered and was thought to be a floating kidney, for the rectification of which an operation was undertaken. At the operation the mass in the false pelvis was found to be an encapsulated tumor firmly attached to and apparently growing out from the anterior and inner surfaces of the lower pole of the left kidney. The mass was considerably larger than the kidney and so intimately united with it that it could not be separated from it without tearing the kidney parenchyma. The two were apparently enclosed in the same capsule. Both kidney and tumor were removed. About six weeks after the operation the patient died, and, according to the autopsy findings, the cause of death was "chronic myocardial degeneration with terminal septic pericarditis." No indication of extension or metastasis of the growth was found. The right kidney was about double the normal size. The right adrenal gland was normal. The left adrenal was not found and it was supposed that it had been removed with the kidney at the time of the operation.

I have been unable to find the gross specimen in this case and can procure no description of its macro-

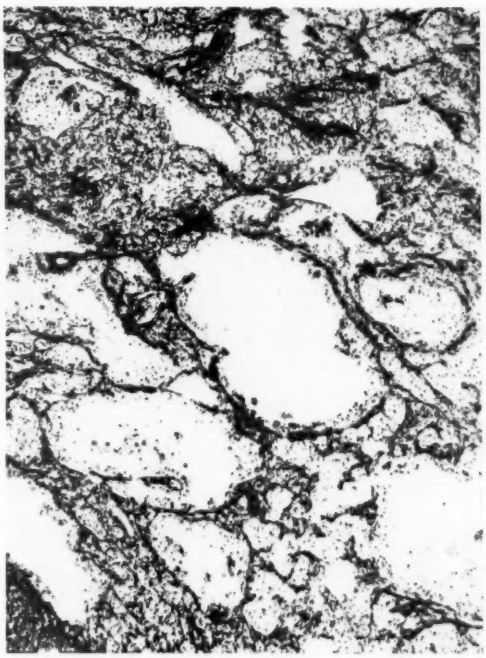

Fig. 6. An area in the same tumor (Case 2, Group 1) showing a secondary phase; namely, fatty changes in the cells and central necrosis of the tumor cordons with the formation of pseudo-tubular structures.

scopic features other than the few details given above. The histological appearance is very similar to that of the adrenal hypernephroma described by Bullock and Sequeira (5). The structure is uniform

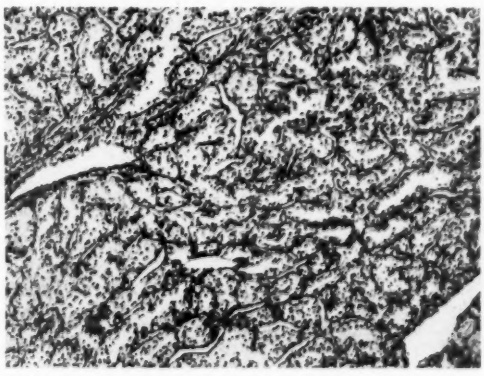

Fig. 7. Low power showing primary structure of adenoma of kidney developing from convoluted tubules. (Case 1, Group 2.)

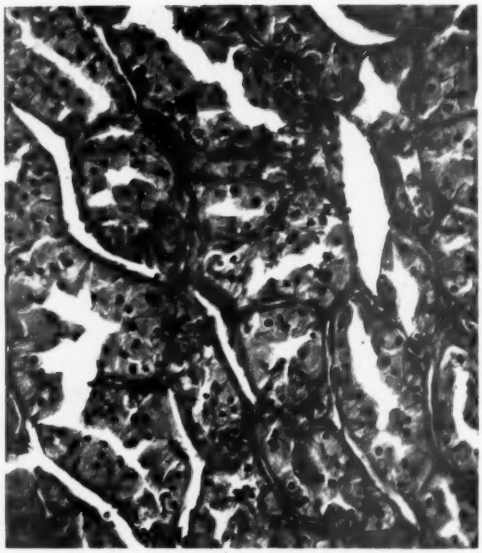

Fig. 8. High power of Fig. 6, showing well-defined tubular structure.

throughout the whole mass and is of an adenomatous rather than carcinomatous type. With the low power, the picture presented is that of solid cordons of polygonal epithelial cells separated by capillaries. These cordons have no basement membrane, but rest directly on the capillary walls from which they are sometimes separated *en masse*, presenting an appearance frequently seen in the columns of the adrenal cortex. In places the cordons are long, narrow and parallel, resembling very much the zona fasciculata of the normal adrenal. In other places they are of varying length and width and somewhat tortuous. There are no papillary, cystic,

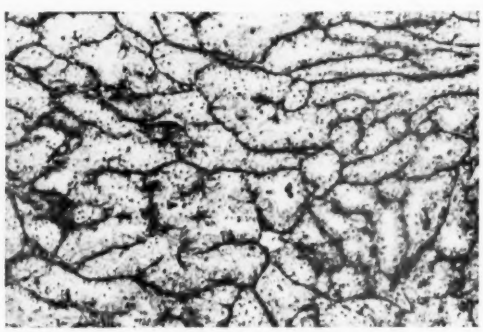

Fig. 9. Same case as in Figures 6 and 7, showing a secondary phase, namely, fatty changes in the tumor cells.

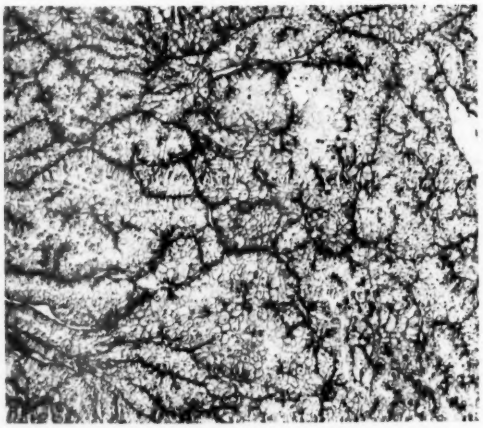

Fig. 10. The same case as in Fig. 8, showing further degenerative changes which give the cells a characteristic "glassy" appearance—the "glassy" cells of Stoerk.

or tubular formations. Sections from areas at the junction of tumor and kidney show tumor immediately bounded by a fibrous band in which are here and there compressed and atrophying renal tubules and glomeruli. The tumor at this point shows no capsule. With high powers the size, shape, and arrangement of the cells are best described by noting their similarity to the cells of the normal adrenal cortex. The cell membrane is non-refractive and frequently poorly defined. The cytoplasm is finely granular and stains moderately pink with eosin. It does not present the "glassy" or "reticulated" appearance so characteristic of the cells in "hypernephroma" of the kidney. Frequently, however, the granules are absent in places, giving the cytoplasm a somewhat "foamy" appearance. The nuclei are round or oval and moderately chromatic. Here and there are hyperchromatic nuclei and occasionally a very large one. Not infrequently the cells have two or even three nuclei or a multilobed nucleus. Mitotic figures are present in moderate numbers. As the specimens had been treated with alcohol, fat stains were not attempted.

In this case there is clinical as well as morphological evidence that the tumor is a neoplasm of adrenal cortical tissue. According to the summary made by Glynn (6) from an exhaustive review and study of tumors of the adrenal cortex, "adrenal hypernephromata are associated with sex abnormalities almost invariably in children, usually in adult females before the menopause, but apparently never in adult females after the menopause, or in adult males," the abnor-

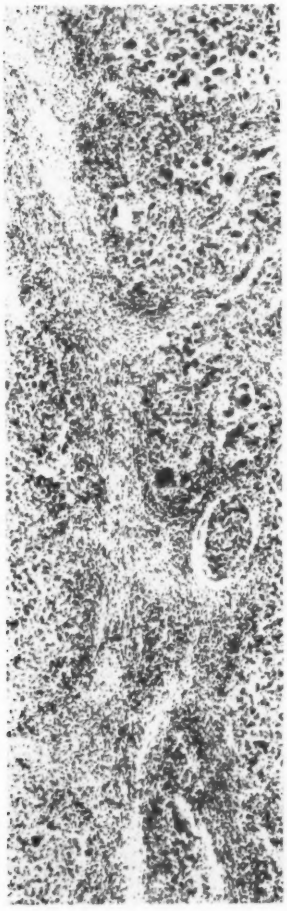

Fig. 11. Another area in the same tumor. (Case 1, Group 1), showing malignant changes; namely, a mixture of carcinoma with giant-cell formation and small spindle-cell sarcoma.

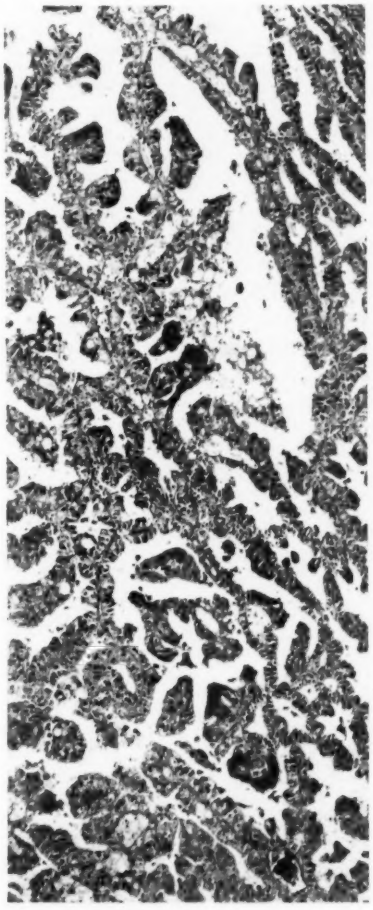

Fig. 12. Low power showing primary structure of a papillary adenoma of the kidney. (Case 2, Group 2.) In the lower third of the picture to the right are seen three tubules in cross section which bear a striking resemblance to collecting tubules. Note, also, the fat-laden tumor-cells in the capillaries at the top.

malities being "the diminution of certain female and the development of certain male characters." In this case we have the general male build, great muscular strength and hirsutes together with non-development of the mammæ. Morphologically, the evidence for the adrenal origin of the tumor is even more convincing. There is not one feature which could suggest a renal origin. The histological resemblance to the adrenal cortex and its primary tumors, on the other hand, is almost perfect. There is only one circumstance which precludes the positive conclusion that the tumor originated from an accessory adrenal in the capsule of the kidney; viz., the failure to find the adrenal on the left side. This leaves a possible alternative that we may be dealing with a hypernephroma of a misplaced adrenal gland.

CASE 2. The patient was a white adult male, aged 54 years. There were no features indicative

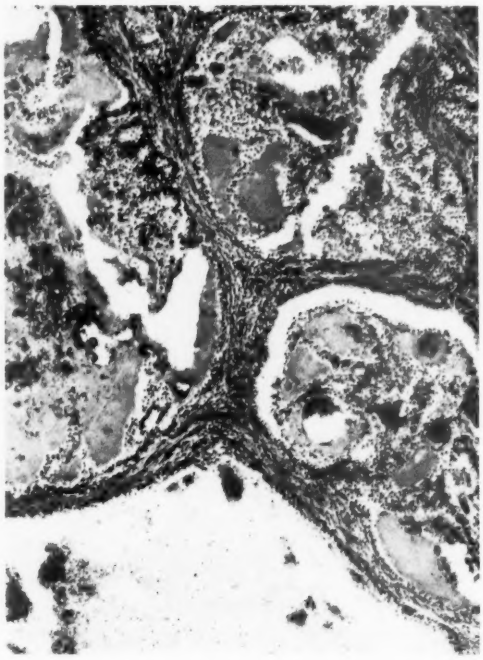

Fig. 13. Low power of a cystadenoma of the kidney. (Case 3, Group 2.) Note the swollen "glassy" appearance of the epithelial cells within the cysts. The dark grayish homogeneous areas represent so-called "colloid," the black areas, blood. The epithelial cells are infiltrating the cyst walls in several places.

of sex abnormalities. His earliest symptoms were hæmaturia and painful urination which persisted for one month and then subsided permanently. Three months later he entered Bellevue Hospital complaining of great general weakness and swelling of the right leg. Later on the left lower extremity became œdematous and cyanotic. Pulmonary symptoms developed and in four weeks the patient died. The autopsy was performed by Dr. Douglas Symmers, who gives the following epitome of the protocol:

The body was that of a man, 54 years of age, 170 cm. in length, of large, well-developed frame, fairly good musculature and nutrition. Both thighs and legs were swollen and pitted deeply on pressure. The body was eviscerated from tongue to prostate. Thyroid: The right lobe of the thyroid was enlarged, measuring 7 x 4 x 4 cm. On section this lobe was found to be almost completely converted into grayish tumor material of moderately soft consistence. The left lobe was not affected. Lungs: Both the visceral and parietal pleuræ were richly strewn with large and small, oval or rounded, cream colored or faintly pinkish tumor nodules. The diaphragmatic pleura just above the spleen presented an enormous conglomerate of tumor nodules. On section of the left lung, there was a huge mass of greyish, finely granular tumor tissue lying in the lower lobe near the base. Smaller masses were found scattered irregularly throughout the rest of the organ. Large and small nodules of similar appearance were embedded in the right lung. Liver: The liver was considerably enlarged and, on section, numbers of tumor nodules were found scattered through the substance of the organ. Kidneys: The right kidney was greatly enlarged, forming a nodular mass 18 cm. in length and 10 cm. in breadth. On section the organ was found to be extensively replaced by grayish or cream colored nodules, moderately soft in consistence and, in places, hæmorrhagic or necrotic. Some of the nodules were separated by glistening bands of connective tissue, others were fused. Tumor tissue extended directly into the pelvis of the kidney and into the right renal vein, where it was attached to the intima of the vessel and formed a partially occluding thrombus. The right internal iliac vein was similarly occluded by infiltrating new-growth. An enormous tumor mass was present in the retroperitoneal tissues corresponding to the point of junction between the iliac and inferior vena cava, and nodular extensions from this growth penetrated the walls of the inferior vena cava, showing beneath the serous lining as pale, perfectly smooth elevations. The vena cava was opened and found to be greatly distended in that portion lying just back of the liver. The distention was due largely to the presence in the lumen of a cream colored thrombus of tumor tissue which extended directly up the vessel wall stopping just short of the right auricle of the heart. In the opposite direction the neoplasmic thrombus was directly continuous with the thrombus described in the renal vein. Both suprarenal capsules were dissected out and were found to be in a state of excellent preservation. The remaining organs presented nothing worthy of comment at this time.

Anatomical diagnosis. Primary hypernephroma of right kidney. Neoplasmic thrombosis of the right renal vein extending into the vena cava as far as the right auricle of the heart; metastatic hypernephroma of pleuræ, lungs, liver, thyroid, and retroperitoneal tissues; œdema of lower extremities following occluding neoplasmic thrombosis of the iliac vein and inferior vena cava.

Histologically the most interesting feature in this case is the finding of three separate pieces of adrenal cortex in the tumor mass; one measuring about 3 x 2 x 2 cm. at the upper pole of the kidney, a somewhat larger one midway between the upper pole and hilus on the inner surface, and a third at the lower pole and continuous with a lobulated tumor mass which bulges from the whole posterior surface of the kidney. The upper two of these bodies show in places the three cortical layers with especially large zonæ reticulares which contain numerous

deeply pigmented cells. None of the tissue was treated with chrome salts and consequently the presence of chromaffin cells cannot be excluded with certainty, but apparently none is present. In the uppermost body, however, there are blood-vessels in the neighborhood of which are numerous ganglionic cells and nerve-trunks. In the body at the lower pole of the kidney different cortical layers are not distinct but the whole outer surface of the body is made up of columns of unmistakable adrenal cells, many of them pigmented, which imperceptibly merge into the structure that constitutes the main tumor mass. The uppermost body is partially split into two parts by a fibrous band in such a way that one portion lies above the kidney and the other dips down into it becoming continuous with the main tumor growth. In the upper part are several adenomatous nodules such as are commonly seen in the adrenal gland, and a few of these have become metamorphosed into the structure that may be called the "primary" phase of the tumor growth. These nodules have no fibrous capsule and show no inflammatory reaction at their border. Their histological appearance is so similar to that of the neoplasm in Case I that a reference to that will serve for its general description. The tumor columns are directly continuous with the surrounding columns of the accessory adrenal and it is impossible to say just where the tumor commences. The adrenal columns as they merge into tumor cordons become tortuous and the intervening capillaries dilate. The tortuosity and capillary dilatation increase as the center is approached and the columns become broader. With the high power the changes noted are increase in the number of the cells, pyknosis of the nuclei, swelling and vacuolization of the cytoplasm with a sharper definition of the cell outline. Stained with Sudan III the vacuolization is seen to be partly due to the presence of fat. In one of the nodules the cells of the central cordons, instead of showing vacuolization of the cytoplasm, have undergone a carcinomatous change, the cytoplasm being scanty, the nuclei hyperchromatic and in some cases multiple.

An exaggeration of the changes above noted in the central portions of these nodules marks the beginning of the "secondary" phases of growth which constitute some of the most striking histological features of the tumor. The most widespread of these changes is the swelling, with fatty infiltration of the cytoplasm, giving the cells the "hypernephroid" appearance so commonly seen in renal hypernephromata. Occasionally small areas are seen in which the cell outlines are very sharply defined and refractive, while the cytoplasm is utterly devoid of granules or vacuoles, the cell as a whole having that "glassy" appearance which Stoerk claims is a change found only in renal and never in adrenal cells. Stained with Sudan III these "glassy" cells sometimes show a large amount of fat and sometimes none, in which latter case the appearance may be due to hydrops, as Stoerk claims.

Further changes, apparently closely connected with these degenerative phenomena, are hæmorrhage and necrosis, of which the earliest manifestation is in the central portion of the cordons and especially in those that have grown very large. As a result of these changes a pseudo-tubular structure is developed, so called "blood-tubules" in case of the former, and sometimes empty tubules in case of the latter. Sometimes among the blood-tubules are seen tubules containing a substance staining pinkish with eosin which might be mistaken for a "colloid" secretion. On close inspection it is quite evident that this substance is laked blood. This tubular formation is clearly an artefact. The lining epithelial cells have no cuticular membrane and lack the regularity of disposition belonging to true tubules, while comparison with earlier stages of the change in neighboring cordons leaves no doubt as to its true nature. Occasionally in these pseudo-tubules there is an appearance of a papillary invagination of the wall, but this too, is plainly an artefact due to the plane of section and is made possible by the peculiar tortuosity and sudden bending of the cordons. Another secondary phase of quite different nature is constituted by the malignant changes. These are especially common in the metastatic nodules in the lungs but occur anywhere. Indication of malignant changes in individual cells may occur early, as was seen in one of the nodules in the accessory adrenal. Later phases are constituted by loss of columnar structure and irregular arrangement of the cells. Syncytial giant cells are common. Some of these areas can be justly interpreted as carcinomatous and others as sarcomatous.

In so far as morphological evidence can go this tumor bears every mark of being a neoplasm of multiple adrenal cortical bodies located in or about the capsule of the kidney. The exclusively cortical character and the location of these bodies, coupled with the fact that the adrenal gland on the same side was found intact, prove conclusively that they were "accessory adrenals."

GROUP II—TUMORS OF RENAL ORIGIN

Before describing a few cases in this group, it may be well to say a word about the nature of the evidence on which the classification is based. The morphological evidence adduced by the advocates of the "renal origin" hypothesis rests on the presence in the tumor of true tubules, cystic, or papillary formations, the tubule being the *sine qua non* of the latter two. The advocates for the "adrenal rest" origin, on the other hand, object that these structures are quite possible developments from adrenal tissue inasmuch as tubules have been found both in the adrenal gland and in its tumors. The evidence in support of this objection, however, is of a most flimsy character. For the presence of tubules in the nor-

mal adrenal the only evidence I have been able to find is the statement of Marchand (7) that "lumina" are present in the adrenals of horses. Other writers on the adrenal either positively deny the presence of tubules or do not allude to the question. Thus Stoerk concludes from his investigations upon the adrenal cortex of man, the cat, the dog, and the rabbit that true lumen formation is absent in physiological and pathological conditions; viz. hypertrophy and adenoma (8). Zehbe in 150 human adrenals found no indication of tubules. The standard authorities on embryology and histology, including Poll, who has worked extensively on the development of the adrenal in vertebrates, make no mention of tubule formation. In the case of tumors of the adrenal, Manasse (9), Askanazy (10), and Kelly (11), each describe a case in which there was lumen formation. The adrenal origin of the latter two cases, however, is doubtful as there was tumor growth in the kidney and other organs. Dobbertin (12) described a case in which there was lumen formation and papillary structure. He gives no illustrations but intimates that the lumina were irregular in formation and filled with necrotic débris, a circumstance which arouses the suspicion that both they and the papillary structures were artefacts produced by necrosis. Ribbert (13), Winkler (14), Marchetti, and others have observed these pseudo-tubular and papillary formations, giving them their true interpretation, and we have already described them in Case 2 of Group I.

It seems evident from the above facts that the presence of true tubular structures in a primary neoplasm of the kidney ought to be regarded as strong evidence that the neoplasm is autochthonous. If, moreover, instead of occurring at random, or accidentally, as it were, they are found to follow in their development certain special types of structure which have for their prototypes changes which are not uncommon and indubitably autochthonous in the kidney, the evidence is convincing.

In regard to the histological structure of the tumors in Group II, it may be said generally of all, first, that they contain sufficient extent of "hypernephroid" areas to have justified the diagnosis of "hypernephroma"; and, second, that they show a sufficiently clear picture of true tubule formation to justify their classification as tumors of renal origin. In many the primary structure of the growth is more or less obscured by secondary degeneration or by malignant changes, but in several it is well preserved, and in each of these latter cases the tubule formation, or what is fundamentally tubule formation, follows in its development some special type of histological structure.

The different structural types followed in these well-marked cases may be classified as follows:

I. Adenoma
II. Papillary adenoma
III. Cystadenoma
IV. Papillary cystadenoma

In Type I the structure consists of tubules separated by capillaries. Though short invaginations of the tubule walls are not infrequently seen, the characteristic tendency of growth in this type is not "papillary" formation but the piling up of the lining epithelium, as a result of which the tubules are transformed into solid cordons. The distinguishing feature of Type II is found in the dilation of the tubules accompanied by long, clean-cut, papillary invaginations of the tubule walls. A characteristic secondary change is the proliferation of the epithelium on the papillary ingrowths, which ultimately fills the tubules. In Type III the unit of structure is a cavity lined internally by epithelium and externally by fibrous tissue. The epithelium grows inward in solid masses or in the form of tubules, some of which are distended with a homogeneous substance which stains like colloid. Occasionally the whole cyst is filled with this substance. If there are papillary formations they are evidently artefacts or of the type seen in Type I. In Type IV the structure is the same as in Type III except that the epithelium grows inward in tree-like formations on stout branching fibrous stems. In both Types III and IV the epithelial growth tends to fill up the cyst cavities and by eversion to infiltrate the cyst walls, in both cases forming cordons of cells separated by capillaries.

These types may be fundamentally one and their differentiation may mean nothing. They are recorded here simply as a matter of fact. It may be said, however, that each of the tumors in which the primary structure is well preserved follows one of these types to the exclusion of the others, both in the primary growth and in the extensions or metastases, a fact which lends some weight to the suspicion that the types are inherently different or at least associated with different conditions. It might be mentioned, too, that the cystic types are always closely associated with chronic inflammatory changes which exist not merely at the advancing edge of the growth, but throughout the whole mass—a fact which suggests a possible association with chronic interstitial nephritis. Inflammatory changes are found in Types I and II also, but apparently only at the advancing margin of the growth. In regard to age, the cystic types all occurred in patients of advanced age. In the youngest three patients in Group II (42, 44, 50) the tumors were of Type I. But the facts available are too meager for further discussion of these details. The essential points to be noted are, first, that these four types do occur as the primary structures from which a number of so-called hypernephromata have developed, and, second, that they are, according to our claims, identical with those varieties of neoplastic and regenerative change which are frequently observed in the kidney in circumstances which exclude all doubt as to their renal origin, the best support of which claim will be found in a brief description with illustrations of one tumor of each type.

CASE 1. This tumor occurred in a woman aged 50, who gave no history of symptoms. The tumor was discovered accidentally and removed surgically by Dr. George D. Stewart. An apparently complete recovery was made but at present, one year later, there is a recurrence of the tumor growth in the abdominal scar. The tumor consists of a mass, measuring 22 x 19 x 15 cm. and completely replacing the kidney. It is covered by a thick, fibrous capsule to which is adherent a large amount of fat, and which strips easily except in a few places where it is infiltrated by outgrowths from the tumor. The stripped surface is grayish in color, coarsely granular, like the surface of a "granular kidney," and marked off into six large bulging lobes of about equal size which are separated by deep fissures. Here and there projecting from the surface of the large lobes are moderately elevated sessile nodules varying from the size of a pea to that of a walnut. There are also one or two bunches of agglutinated small lobules of different sizes. Many of the large lobes on palpation are semifluctuating. On section the central portion of these lobes is found filled with a gelatinous semisolid substance. The cavities containing this substance are lined by ragged necrotic tissue. Scattered throughout the whole cut surface there is a moderate number of alternating dark reddish, whitish, and yellowish areas.

The histological appearance is most variegated. Sections taken from the granular nodules on the surface of the large lobes, which probably represent the most recently formed parts of the tumor, show a remarkable picture of tubule formation, which is an almost perfect reproduction of the convoluted tubules of the renal cortex. The tubules show no indication of necrosis or hæmorrhage which might arouse the suspicion that they are artefacts. On the contrary, they are well preserved and show every mark of true tubules. The cells lining them rest on a basement membrane and frequently their inner surface shows a cuticular membrane. Occasionally there is only one layer of cells lining a tubule and the nuclei are placed in an even row at the base, but as a rule the cells are abnormally increased and the nuclei more or less irregularly situated. In some cases the epithelium is heaped up so as to fill the lumen, thus transforming the tubules into solid columns. Under the pressure of the increased epithelial growth these columns tend to expand and to become tortuous. Here and there the walls are invaginated and give the appearance of "papillary" ingrowths, but on close inspection it is seen that the appearance is due to section on a plane where the tubule or column is twisted or bent upon itself. The cytoplasm of the cells is markedly granular and contains no fat. The nuclei are large, round, and moderately chromatic. The cell as a whole, in general appearance and staining characteristics, is indistinguishable from those of the renal convoluted tubules (Figs. 7 and 8).

Sections from the yellow areas show solid columns of cells following the same general arrangement as above described with only here and there a discernible tubule. The cell cytoplasm is almost devoid of granules, those that are present being very fine and arranged in the form of a delicate reticulum, the meshes of which are filled with fat. The nuclei are small, pyknotic, and irregular in shape and situation. The cell outline is distinguishable, but is dull and non-refractive (Fig. 9).

Sections from certain non-granular areas of rather indefinable color show a general picture similar to that of the yellow areas, but the cells present a distinctly "glassy" appearance. The cell outline is sharply defined and highly refractive. The cell body is apparently empty, or rather it is bulging,

with some substance that takes neither the ordinary nor fat stains (Fig. 10).

Sections from the dark red areas show hæmorrhage and numerous so-called "blood-tubules" so commonly seen in hypernephroma.

Sections from other areas having no special macroscopic mark of description, show sometimes carcinoma of a large-cell type with large hyperchromatic nuclei and the formation of multinucleated and syncytial giant cells, and sometimes round-cell, giant-cell, or small spindle-cell sarcoma (Fig. 11).

This tumor undoubtedly started as a simple adenoma of the convoluted tubules. Later on as a result of exuberant growth of the epithelium together with supervening degenerative and malignant changes, it presents all the different appearances that have ever been observed in so-called hypernephroma of the kidney.

CASE 2. The clinical history of this case was not available. The right kidney is completely replaced by a tumor mass about the size of a grapefruit. The mass is spherical in shape and presents an even, smooth surface. On section the knife becomes covered with grease. The cut surface shows numerous medium-sized, encapsulated areas the majority of which are yellowish in color and soft and greasy in consistence. Others are dark red and several are necrotic. The right adrenal gland is replaced by a mass about the size of a small orange, and on section, presents an appearance similar to that of the kidney mass. The renal and adrenal veins, the vena cava and the right auricle of the heart are almost completely filled with similar tumor growth. There is slight extension of the growth from the vena cava into the adjacent portion of the liver, but there are no metastases anywhere.

The histological features of this tumor are very clean cut. There are perfectly formed tubules which are long, tortuous, and dilated so as to permit numerous long papillary invaginations of the walls. The epithelium on these ingrowths tends to pile up until ultimately the tubules are turned into solid columns. The cells lining the tubules are of the columnar type with well defined cell membranes and deeply staining nuclei which are placed in even rows near the basement membrane, giving the tubules a striking resemblance to the renal collecting tubules. The nuclei of the cells on the invaginated portions, however, are irregularly placed, being frequently at the top of the cells. The cytoplasm of the cells in all parts of this tumor is filled with fat. Of all the tumors examined this one shows the greatest fat content. In numerous places the papillary growth is so extensive that the tubules give the appearance of the tortuous solid cordons of cells, thus presenting the histological picture which is usually diagnosed as "hypernephroma." Sections from the adrenal mass, the vena cava, and right auricle of the heart, all show a similar picture of perfect tubular and papillary formations. There is no indication of carcinomatous or sarcomatous change anywhere. A dominant feature of this tumor, which is also seen to some extent in Case 1 of this group, is the presence of fat-laden tumor-cells in the capillaries. Everywhere the capillaries are widely dilated and plugged with these cells.

This tumor is unquestionably a malignant papillary adenoma of the kidney, and if morphological appearances mean anything, it arises from the collecting system of tubules (See Fig. 12).

In regard to the presence of fat-laden tumor-cells in the capillaries, and especially in view of the fact that the vena cava and right auricle of the heart were stuffed with tumor growth, it is worthy of suggestion that large numbers of these cells must have been present in the peripheral circulation. And when it is called to mind that these tumors as a class show a tendency to travel in the veins it is only natural to believe that the finding of fat-cells in the blood ought to be a valuable means of clinical diagnosis. That this is not so may be due to the fact that fat stains are so seldom used in the examination of blood smears that the presence of such cells escapes detection, inasmuch as with ordinary stains they could easily be mistaken for large mononuclear leucocytes or large lymphocytes.

CASE 3. This tumor was removed surgically. The clinical features showed nothing worthy of comment. It is a large mass completely replacing the kidney and measuring .20 x 14 x 13 cm. Its surface shows numerous small lobulations. The cut surface presents a honeycombed appearance, the cavities containing a semisolid, gelatinous looking substance. On close inspection it can be seen that these cavities are true cysts.

The histological features of this tumor illustrate Type III. Throughout the whole mass are found cysts with strong fibrous walls lined internally by cylindrical epithelial cells with well-preserved nuclei and perfectly clear, "glassy" looking cytoplasm. The fibrous walls are fairly cellular and infiltrated with a moderate number of round cells. The epithelium extends inward in the form of solid masses separated by capillaries, or in the form of tubules which are frequently distended with a homogeneous substance which stains like the colloid casts in chronic nephritis. The fibrous wall is never invaginated, only the epithelium, basement membrane, and capillary. Some of the cysts show a large amount of "colloid" with only remnants of tubules and epithelial masses scattered here and there. Frequently there are free red blood-cells scattered through the colloid or arranged in masses at its

periphery. Other cysts show blood in masses in the lumen of tubules — so-called "blood-tubules." In certain areas where the kidney structures are partially preserved are smaller cystic formations which are intimately associated with the remnants of tubules present, the whole presenting an appearance sometimes seen in marked cases of chronic interstitial nephritis. In comparing all the different structures in such an area and its vicinity it is difficult to suppress the convinction that one sees a gradual transition from these simpler structures into those that are undoubtedly neoplastic. Frequently the lining epithelium of the cysts grows outward, infiltrating the cyst wall and finally replacing it, in which process the structure of cell columns separated by capillaries is maintained. In this way a number of cysts become confluent and give the appearance of large areas of cordons of glassy epithelial cells; to wit, the picture of "hypernephroma." There is very little fat in this tumor and this is not in the glassy looking cells but in necrotic débris.

The prototype of the primary structure of this tumor is undoubtedly the cystadenoma not infrequently seen in the renal cortex in association with chronic nephritis. A striking feature is the large amount of "colloid." It is claimed by Stoerk that this substance is a secretion and consequently evidence of the renal origin of the tumors in which it occurs. Ipsen (15) in his cases found it always associated with hæmorrhage and thinks it is a product of changes in the extravasated blood. In this tumor it is mostly always associated with hæmorrhage and degenerative changes in the epithelium, but occasionally it is present in cysts which are absolutely free from any trace of blood. Another feature of note is the comparative absence of fat in the "hypernephroid" cells. This circumstance also would be regarded by Stoerk and his followers as evidence of renal rather than adrenal origin, though according to the findings in Case 2 in Group I of our tumors it ought to be held of doubtful value.

CASE 4. This case differs so little from the cases in Type III that a very brief description will suffice. The kidney is completely replaced by a large spherical shaped mass about the size of a large grapefruit. The distinctive feature of this tumor is the presence of papillary formations and this can be determined in the gross. The cut surface presents a finely villous appearance. The tissue is very friable and large portions of it are necrotic. If sections of it are placed in water the papillary formations are floated out and can be recognized. The adrenal gland and peritoneal surfaces on the same side are infiltrated with small nodules of the growth.

Histologiclly, the picture is that of a papillary cystadenoma, the distinguishing feature being the papillary tree-like ingrowths from the cyst walls. The same type of structure is followed in the metastases. The epithelium on the ingrowths piles up, filling the cyst cavity, and also grows outward, replacing the cyst walls as in Case 3. In the solid masses thus produced the cells are swollen and infiltrated with fat, the whole presenting an appearance on which the diagnosis of hypernephroma was based.

The structure of this tumor differs from that of Case 3 in two respects: first by the presence of papillary ingrowths on stout fibrous stems, and second by the absence of "colloid" in the cysts. These differences may be only accidental but it is a notable fact that the same differences divide the cystic formations which occur in the kidney in association with inflammatory conditions.

In regard to the frequency of occurrence of each of the four types, of the well preserved tumors 9 follow Type I, and 2 each of the others. The majority, if not all, of the remaining tumors probably belong to Type I.

CONCLUSIONS

1. Of 34 so-called hypernephromata of the kidney, there is convincing evidence, from both the clinical and morphological viewpoint, that one of the number was a neoplasm originating in an accessory nest of cortical adrenal cells, although the possibility of origin from the cortical cells of a misplaced adrenal composite cannot, of course, be denied. It is interesting to note that the patient in whom this tumor was found, was a female with pronounced male characteristics.

In still another case of so-called hypernephroma of the kidney, the morphological evidence tends strongly to support the view that the tumor arose from multiple nests of adrenal cortical cells lying in or around the capsule of the kidney. In the remaining 32 instances of so-called renal hypernephromata, however, the morphological evidence indicates that the tumors were derived from renal adenomata. In other words, it would appear from this that the majority of cases of hypernephromata is misnamed and should be classified as nephromata, the term hypernephroma being reserved for malignant tumors arising from cortical adrenal cells.

2. It has been shown (a) that the primary structures of tumors of adrenal origin are essentially different from the primary structures of tumors of renal origin; (b) that the primary structures of adrenal tumors never imitate the primary structures of renal tumors; (c) but the primary structures of some renal tumors (adenomata) can, at an early stage, through proliferative changes, imitate the primary structures of tumors of renal origin; (d) both tumors of adrenal and of renal origin can undergo secondary degenerative and malignant changes, which make their histological features very similar, these changes being practically always present in the renal tumors. On the other hand, they occurred in only one of the two cases of adrenal growths above described. Consequently I believe that the diagnosis of hypernephroma should not be based on the strength of the appearances presented by those parts of the tumor in which secondary degenerative and malignant changes have occurred.

I wish to acknowledge my gratitude to Drs. Douglas Symmers, Charles Norris, George D. Stewart, and Guy H. Wallace for their cooperation throughout the course of this work.

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A CONTRIBUTION TO THE STUDY OF "TWILIGHT SLEEP"[1]

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CORRECT judgment in medicine is formed by expressing the intrinsic values from a vast number of individual observations. This must serve as my only excuse for contributing so small a quota as 100 cases of "twilight sleep" to a happily ever-increasing literature. Our experience with morphine-scopolamine analgesia in labor has given us a very favorable opinion of its value, and we hope the citation of our cases and their analysis will encourage a wider trial and a deeper study of this lethean method of delivery. To consider the question fairly we must free our minds from the visions aroused by over enthusiastic advocates of "twilight sleep" as well as from the prejudice excited by its popular exploitation.

These deliveries are not entirely painless and cannot be, for the method is not to be initiated until the woman has had enough pain and had it so long and regularly as to demonstrate that she is certainly in labor. The prospective mother must be informed of this so that she will not look for a confinement such as the lay press has inclined her to expect — a labor wherein she lies down to pleasant dreams and awakens refreshed, only to find her newborn child at her side. Besides the pain which begins the labor, she must expect to have certain periods during the delivery where pain will be present. These so-called "islands" of pain last from fifteen minutes to half an hour and represent the partial return to consciousness of a woman who is carrying just the required amount of narcotic and no more.

Our technique at Wesley Memorial Hospital follows in the main the rules laid down at Freiburg. We must note, however, a few exceptions. Our delivery rooms are not

[1] Read before the Chicago Gynecological Society, January 21, 1916. (See discussion p. 744.)

padded nor are they impenetrable to street sounds although silence on the part of the attendants is faithfully observed. The subdued light and the absence of relatives we regard as very important, especially the latter for it is a simple thing for an observing friend to fill out the lacunæ between the islands of memory with a description so graphic that the patient is soon convinced that she felt everything as usual. It has happened occasionally that the husband is instructed to hold the patient's hand and watch minutely what takes place so that he may inform his wife later. He agrees to do this, unconscious of the fact that he thereby jeopardizes the success of the treatment.

Our preparation of scopolamine was deliberately chosen from domestic products with the idea of having a drug that would always be available. We used tablets almost exclusively.

We have not employed the memory test rigorously in all our cases since by practice we think we can recognize, in a measure, the degree of drug control by such physical signs as somnolence, flush, mental confusion, and the reaction to uterine pain.

In this series of 100 consecutive cases the dosage has been limited meticulously. In no case was the morphine given but once and the scopolamine was repeated only as the symptoms in each case seemed to require. Every patient has received the most careful supervision both of person and of environment throughout the labor. The advance of the presenting part, the frequency and duration of the contractions, and the maternal heart sounds and those of the child are observed as frequently as it can be done without disturbance. Individualization is the secret of success.

Our observations give the following results: Primiparæ 44; multiparæ 56. The longest labors were 29 hours; 25 hours; 23 hours, respectively. The shortest labor was 55 minutes. The average of all cases was 8 hours 37 minutes. In 63 cases, labor was inaugurated with a Voorhees bag. The three stages of labor averaged six and one-half hours, one and three-quarter hours, and 22 minutes.

As an important factor in shortening labor we may mention that as soon as dilatation is complete and the presenting part well engaged the patient is aroused with the onset of each contraction and urged to bear down. This can be done in most cases without making a "memory island."

Dosage. Morphine sulphate $^1/_8$ to $^1/_6$ and scopolamine hydrobromidum $^1/_{150}$ to $^1/_{300}$ grains were injected under the skin when the contractions were five minutes apart or less.

After an interval varying from fifteen minutes to four hours with an average of one and one-quarter hours the scopolamine was repeated in doses of $^1/_{150}$, $^1/_{200}$, or $^1/_{300}$ grs. The next interval also varied from one-half hour to four hours with an average of one and one-half hours when the scopolamine was repeated as before in a dose appropriately determined by physical signs or memory test. A third dose might or might not be required. In our cases we gave scopolamine twice in 59 cases; thrice in 12 cases; four times in 4 cases; five times in 1 case; in 22 cases only the single initial dose of morphine and scopolamine combined, was administered.

After beginning the injections the following results were obtained as regards pain.

Fourteen felt a few pains; one said she suffered almost as much as when she had her menstrual flow. In 15 pain was greatly diminished but not entirely abolished. In 56 there was no pain whatever. In two cases no relief was admitted. Three women claimed post-partum that they felt every pain just as usual although they showed the mental confusion and the physical signs of drug saturation. One claimed she became fully conscious every time she was aroused to bear down and declared she would have gone through all right if she had been allowed to sleep as ordained in the articles she had read. The injection was given too late to be effective in one case. Four women threw themselves about violently on the bed and showed great mental excitement but afterward reported no pain. In six cases the injections were abandoned on account of weak contractions which threatened a cessation of the labor.

A larger experience will enable us to recog-

nize these cases earlier and either exclude them from "twilight sleep" or possibly give it later when the uterine function has acquired a greater momentum. In a certain proportion of the labors when the head is deeply engaged and the os well dilated, pituitrin can be given with excellent results.

There were two maternal deaths in this series, from placenta prævia complicated with myocarditis and from hæmophilia.

The placenta prævia was centrally implanted but there had been no external hæmorrhage and the diagnosis was not made until the woman went into labor. The hæmorrhage was not great but the shock of delivery was too great for the injured heart muscle and she died two hours after the baby was born. The hæmophiliac never formed a clot from the moment the child was delivered, and finally died with the blood trickling through gauze, tightly packed in a firmly contracted uterus. Neither of these cases should have had "twilight sleep."

Eight babies died. Three were macerated and of these, two were twins with hydramnion. The absence of heart-tones and the presence of other symptoms forewarned us of conditions inside the uterus but for that reason it was decided to protect the mothers as far as possible against the pain of an unrewarded confinement. In one case the cord prolapsed. In another the child was born in asphyxia pallida and was resuscitated with difficulty only to die a few hours later. One was premature. Two were delivered with forceps through the moderately contracted pelves and rigid soft parts of primiparæ. One was stillborn and the other lived two hours. Both had good heart-tones until delivery. Both had but two injections, the first morphine sulphate $^1/_6$ and scopolamine $^1/_{300}$ and scopolamine $^1/_{300}$ in one-half hour to two and one-half hours respectively.

None of these deaths, in our opinion, can be attributed to "twilight sleep."

Three babies were born blue (asphyxia livida) and breathed easily and promptly as usual. Two babies were born in oligopnœa and revived thoroughly and permanently in 15 and 20 minutes respectively. Low forceps were applied 23 times and axis-traction 2 times. Breech extraction was done three times and version and extraction twice. The perineum was torn to the 2° or less, 23 times.

In about 50 per cent of the cases a few whiffs of chloroform seemed desirable as the head passed the perineum.

We had four cases of violent mental and muscular excitement and these were the only cases in which any restraint was used. All were Jewesses. None of the patients developed insanity. The third stage was not affected, so far as we could see.

The mammary function was uninfluenced unless the absence of exhaustion and the conservation of energy might, as some have stated, result in a more abundant supply of milk. This would be a pure assumption on our part as we have no corroborative observations.

Certain objections have been urged against morphine-scopolamine analgesia which in our opinion are unjustified.

First, as to the prolongation of the labor: It is probably true that the contractions are somewhat retarded by the numbing of the sensory nerves, but this delay rarely exceeds six or seven hours which is far less destructive to the vital powers than the same labor without analgesia even if shorter. To a woman free from pain it is negligible. To the attendant who is supposed to be devoting his time to the case conscientiously and who has arranged for the additional assistants required, the prolongation of the delivery is of no consequence. On the other hand if the obstetrician desires a short labor it is only a matter of technique and training to obtain it wisely and conservatively either with or without "twilight."

The fœtal asphyxia and the "blue babies" which are used as arguments by the laity and others equally inexperienced or cunning, are no more common with "twilight" than without it. As a matter of fact a blue baby is a natural result of an excess of carbon dioxide in the blood and this excess is the physiological precedent and stimulant to normal respiration. It is only through the accumulation of carbon dioxide in excess that the respiratory centers are driven to functionate with the result that oxygen is taken in.

Difficult control of the patients we found in but 4 per cent of the cases and we feel that this objection can be obviated by a more rigorous discrimination.

Post-partum hæmorrhage occurs just as frequently in "twilight sleep" as out of it and no more so.

One writer has condemned the method because the signs of the onset of the second stage are unrecognizable except through more frequent internal examination.

This may be true with the general practitioner but at the present time the development of "twilight sleep" is or should be in the hands of specialists and anyone worthy of this name should be able to determine the onset of the second stage by external palpation, that is by following the descent of the presenting part with the finger tips.

Again it has been urged that the freedom from pain, which opponents of the treatment concede, is unfortunate because the symptoms of antepartum hæmorrhage and uterine rupture may be obscured and the life of the patient endangered. In hospitals where the diagnosis of antepartum hæmorrhage or uterine rupture is made, not upon the declarations of the patient, but upon anatomical findings, this argument, of course, is not valid.

It has also been stated that the restlessness and violence of the patient predisposes to soiling the genitalia with fæcal matter.

As we have shown above, mental agitation and muscular excitement are rarely observed except in Oriental peoples and even if it did occur, it would be impossible for the soiling to follow if the colon had been emptied by an adequate and conscientious preparation.

Examination of the various arguments against "twilight sleep," as properly administered, seems to disclose the prevalence of a feeling that it is better for the woman to suffer than for the objectors to take up the burden of higher responsibility, of assiduous attention and the more exacting obstetrical skill which these cases demand.

It is quite in the course of things that a method of treatment which presents so many opportunities for the intrusion of the personal equation by patient or attendant, or both, will exhibit an astonishing variety of reactions not only during the labor but afterward. Hence the reports will show many diverse results until the elimination of minor differences brings the most important points to standardization.

From observation of our cases we believe the morphine-scopolamine analgesia is entirely harmless both to mother and child when properly administered.

We believe the treatment has been successful in our hands since we show 29 per cent of our cases were practically, and 56 per cent entirely, free from pain—or 85 per cent in all.

We find the strength is conserved and the convalescent period shortened. Whether or not the woman gets up earlier is with us a question of uterine involution rather than one of days or strength or treatment. The main thing is that she feels better much sooner.

It is our opinion that primary pain weakness, hæmorrhage, prolapsed cord, and a lack of correlation between the size of the pelvis and the child, make conditions that are unfavorable for "twilight sleep".

We do not believe that "twilight sleep" will succeed in every case, but it does no harm when properly used and we are convinced it will act happily in about 85 per cent of the cases that are selected with due regard to the contra-indications.

We believe "twilight sleep" to be a valuable and permanent addition to the resources of the obstetrician, and that much of the antagonism to it arises from an inability or an unwillingness to bestow upon a woman in labor the unremitting attention and the higher technical proficiency which these cases demand.

END-TO-END SUTURE OF THE BILE-DUCTS

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THE bile-ducts present a field for the most interesting and unexpected surgical opportunities. The literature on the subject, especially the writings of Moynihan, Kehr, Fenger, Mayo, and Jacobson, is most instructive but anything like a formal review would be unnecessary and out of place in this paper.

The mechanism of obstruction and occlusion of the bile passages as given by Schueppel (quoted by Fenger), is briefly as follows:

1. Obstruction from within by (*a*) bodies that fill the lumen; (*b*) cicatricial strictures following local inflammations of the mucosa; (*c*) tumors, benign and malignant.

2. Obstruction from without by compression due to masses of scar-tissue or adhesions, the result of chronic inflammation, peritonitis, or perihepatitis.

3. Deviations of the bile-ducts caused by peritonitic adhesions between the hilum of the liver and one or more of the neighboring organs.

Destruction of a portion of the bile-duct may be the result of trauma, gangrenous inflammation and surgical manipulation, either accidental or intentional.

For the relief of the condition present in any given case one of the following recognized methods of repair or reconstruction would probably be used:

1. Simple suture of the wound.
2. End-to-end anastomosis.
3. Plastic closure or reconstruction by tissue taken from a neighboring viscus, the transplantation of fascia, blood-vessels, or the appendix.
4. Anastomosis of gall-bladder or bile-duct with the bowel or stomach.
5. Construction of an entirely new duct by the use of a rubber tube covered by omental tissue.

My experience in unusual bile-duct surgery has been limited. In 1906 in Baltimore among seven bile-duct operations on dogs three end-to-end sutures of the lower bile-duct were done with rather unsatisfactory results. Two dogs died on the sixth and one on the seventh day after operation from leakage into the peritoneal cavity. That bile had passed into the bowel in each case was certain and as nearly as we could tell the sutures had held perfectly until the fourth day. In each case autopsy showed only a slight separation of the line of suture and peculiarly this opening was located in each case at the point uppermost in the field of operation where one might expect the most accurate suturing to be done. Had drainage been provided for at the time of operation, the dogs might have recovered, but no drains were used for two reasons: first, that we might test the method; and, second, because in other operations where drainage had been provided we had difficulty in preventing the dogs from pulling out the drains. In man this difficulty is not serious and the value of drainage in all bile-duct operations has been impressed upon us by the highest authorities.

Through the courtesy of Dr. A. W. Elting of Albany, New York, I shall now report an unpublished case of choledochoduodenostomy in a part of which it was my good fortune to assist. This case is of interest and value not only in itself but also because the obstructing growth seemed similar macroscopically to the growth in the case I shall report later.

Mr. J. B., aged 53, admitted to St. Peter's Hospital, July 31, 1908. Occupation, contractor. He had not had any serious illness except for an attack of malaria at 11 years of age. This lasted six months and was of the tertian variety. He stated that for the past five years he had bilious attacks occasionally after taking indigestible food, especially cabbage. These bilious attacks were accompanied by nausea, vomiting, and headache. Six weeks prior to admission to the hospital, that is, about June 25, 1908, he first notice jaundice of his skin and conjunctiva. This jaundice gradually increased and about five days later he noticed that the urine was deeply bile stained and that the stools were clay colored. He was sleepy and had marked itching of the skin. He gradually grew worse and after some three weeks went to Saratoga in the hope of recuperating. While there he grew steadily worse and began to have

[1] Read before the Western Surgical Association, Des Moines, December 17, 1915.

fever of an intermittent character with severe irregular chills. The jaundice became very much increased and the general condition very serious, with pronounced toxæmia. At no time had there been any history of severe pain or anything simulating colic. He was seen in Saratoga in consultation by Doctor Elting and was found to be a man fairly well built, although much emaciated, with a very pronounced jaundice. The liver was greatly enlarged and what appeared to be a very markedly distended gall-bladder could be palpated below the right costal margin. There was slight abdominal distention. The urine contained a large amount of bile with albumin and casts. The appearance was that of a case of obstructive jaundice with marked cholæmia. The patient was operated upon July 31, 1908, at which time a very marked enlargement of the gall-bladder was found. The contents of the gall-bladder were of a mucopurulent character. There were no stones. The pancreas appeared to be somewhat uniformly enlarged with no evidence whatever of any pancreatic new-growth, the appearance being entirely one of chronic pancreatitis. The gall-bladder was drained. The patient did very well after operation, although practically all of the bile was discharged through the wound. The stools remained clay colored and there was considerable bile in the urine. The patient left the hospital September 5, 1908, but returned on October 16. There had been no diminution in the amount of bile drainage from the wound, although the skin and mucous membranes had become practically normal in appearance. The second operation was performed on October 17, 1908, at which time a definite obstruction of the common duct just before it entered the duodenum was demonstrated. The distal inch of the common duct with the papilla was excised and the proximal portion of the common duct implanted into the duodenum. Drainage of the gall-bladder was continued. The patient withstood the operation very well. At this time there was some slight enlargement of a few lymphatic glands in the vicinity of the hilum of the liver, but no evidence whatever of any neoplasm. The resected common duct presented macroscopically the appearance of scar-tissue. It was carefully examined microscopically at the Bender Laboratory and reported as a benign stricture of the common bile-duct. The patient made a very satisfactory recovery. The sinus closed fairly promptly and the normal course of the bile was re-established. The patient's health improved greatly and he left the hospital on November 20, 1908, in excellent general condition, with his wound firmly healed and his functions apparently normal.

A few weeks subsequent to leaving the hospital, he started for Europe. The voyage was an exceedingly rough one and the patient was very seasick. During this voyage he became somewhat jaundiced, and in the latter part of January, 1909, his wound reopened spontaneously and began to discharge large quantities of bile. He returned to the United States and was readmitted to the hospital on February 18, 1909, at which time he was considerably jaundiced. The stools were again clay colored. There was considerable bile in the urine, some enlargement of the liver, and a profuse discharge of bile through the sinus, which developed in the scar of his previous wound. The patient had lost considerable weight and looked very ill. An irregular mass could be felt in the region of the scar and was believed to be in all probability carcinoma. An exploratory operation was performed and extensive carcinoma of the upper right quadrant of the abdomen was found. This appeared to have originated from the region of the sutured common duct. At this time a re-examination of the portion of common duct excised at the previous operation was made, and after the study of a very considerable number of sections, a few sections were obtained in which minute areas of carcinoma simplex were found. This corresponded to the microscopical type of carcinoma as revealed at the operation done in February, 1909. The patient lived for about a week after the operation and died from exhaustion. An autopsy was not obtained.

The next case is that of a man referred to me by Dr. A. H. Youngs of Pierre on November 5, 1912.

C. B. T., aged 54; occupation, assistant in U. S. Land Office. Family history unimportant. Personal history, no serious illness. Indigestion on eating heavy food noted during past twenty years. Present illness began in 1906, associated with an attack of indigestion and characterized by pain in epigastrium, nausea, constipation and slight jaundice. This was followed by one or two recurrences, similar in character, during the ensuing year but at no time was the patient seriously ill. Slight attacks were again noticed in 1911 with gradually increasing severity and some loss of weight. A peculiar state of mental depression and increased irritability were noticed by the patient's friends.

Examination showed a large, well formed man. His temperature was normal; mucous membrane of good color; moderate jaundice and a trace of bile in the urine; stools rather light but not clay colored. The general examination was negative but there was moderate tenderness over the region of the gall-bladder. The liver was not enlarged.

The patient was admitted to St. Mary's Hospital on November 7, 1912, with a diagnosis of cholecystitis and cholelithiasis. *Operation* November 9, 1912, ether anæsthesia. An incision was made over the inner side of the upper right rectus. There were many fine pale adhesions between the gall-bladder and surrounding tissues. The gall-bladder small, gray in color, and containing a few small palpable stones. No stones were felt in the ducts but near the juncture of the hepatic and cystic ducts a mass was felt which was thought to be a stone. The field was exposed by packing off the intestines and mobilizing the liver in the manner described by Moynihan, thus bringing the ducts into view. The

cystic and hepatic ducts entered a somewhat encapsulated mass of brownish granular material suggestive of an old abscess and upon clearing this away it was found that the ducts lay parallel for a distance of about 3 cm. The hard substance which had previously felt like a stone was now seen to be grayish white in color, slightly spindle-shaped and situated exactly at the juncture of the three ducts, involving all three. There was no appreciable dilatation of the hepatic duct. Aspiration of the gall-bladder showed bile-stained mucus. A longitudinal incision of the mass showed an annular constriction almost entirely closing the lumen of the hepatic common duct and evidently also obstructing the cystic duct. Macroscopically the mass was about 1.5 cm. long and nearly as thick and appeared to consist of white fibrous tissue. Malignancy could not be ruled out but the lymphatic glands found were large and soft and seemed to be due to an inflammatory process. Because of the possibility of malignancy and the fact that the gall-bladder could not be used in a cholecystenterostomy we resected about 3 cm. of the bile-ducts, including the mass, and did a cholecystectomy, all the tissue being removed in one piece. It was first thought to bridge the gap by a rubber tube passed through the common duct to the bowel but we found it possible to approximate the ends of the severed hepatic and common ducts and accordingly an end-to-end suture was done after the manner devised by Carrel for blood-vessel suture, No. 00 chromic catgut being used. The suture line was covered by omental tissue. The hepatic duct was not drained because of possible valve formation from infolding of the edge of the common duct but a rolled rubber-tissue drain was placed near, but not touching, the site of the anastomosis, and after covering in the raw surface of the liver left by the removal of the gall-bladder the abdominal incision was closed. The patient withstood the operation well. The bowels were moved freely on the third day, bile showing plainly in the stools. On the third day the patient vomited several times and was troubled by severe hiccough but there was no bile on the dressings. After a very restless night, because of the hiccough, a faint stain of bile was noticed the morning of the fourth day, November 12. The biliary drainage gradually increased in amount for several days and on November 16 the stools were clay colored but soon the bile appeared again in the bowel movements and on December 9, 1912, after having been up since November 26, the patient was discharged. Microscopic examination of the constricting mass showed only scar-tissue and the fact that today, three years after the operation, the man is in excellent health would bear out this report. I regret that owing to an accident two years ago which destroyed an entire tray of specimens I am unable to show you this specimen.

In September, 1914, J. H. Jacobson of Toledo, Ohio, in an excellent paper entitled "Repair and Reconstruction of the Bile-Ducts" reported an end-to-end anastomosis of the severed ducts. He carefully reviewed the literature and collected thirty-one additional cases which he classified as follows under the head of "Operative Technique Employed."

End-to-end anastomosis with circular suture, with drainage of the hepatic duct	21
End-to-end anastomosis with circular suture, without drainage of the hepatic duct	2
New duct formed from loop of small intestine	3
New duct formed by rubber tube	2
Hepaticocholangioduodenostomy	1
Cholecyscholedocostomy	1
Plastic closure	3
Not stated	1
	34

In this series there were only two deaths.

In Jacobson's case bile appeared on the dressings on the fifth day and in reality his case and the one here reported were little more than modifications of end-to-end anastomosis with hepatic drainage.

That in approximately 90 per cent of the cases reported injury to the bile-ducts was accidental should serve to emphasize both the frequency of atypical implantation of the cystic duct and the necessity of extreme care in the technique of cholecystectomy. No doubt we have all heard Dr. C. H. Mayo say that "the gall-bladder should never be used as a handle," but that one should begin at the cystic duct in doing a cholecystectomy.

It would be interesting to compare the possible advantages of the method of Sullivan, Stone, Walton, Lanphear, or R. H. Jackson over that which was used in this case, but as this is impossible I present the report as it is, appreciating fully the words of Dr. George Emerson Brewer relative to certain surgical successes: "When aided by nature, a sound constitution, and a high degree of normal resistance."

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SIMPLE SUBPARIETAL RUPTURE OF THE KIDNEY

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SUBPARIETAL rupture of the kidney may be divided into complicated and simple; in the former there is additional damage to other viscera, in the latter the kidney is the only organ injured. A classification based upon the extent of the damage to the kidney is of little clinical or practical value. Simple rupture of the kidney, to which we shall confine our remarks, is much more frequent than are the complicated injuries. In 637 collected cases, 512 were simple and 125 complicated, in another series 30 were simple and 9 complicated; in my personal experience of 5 cases 1 was complicated and 4 were simple.

That rupture of the kidney is not common was shown by the fact that in 1910 in a report on "Primary Suture of Subparietal Rupture of the Kidney" (1), I was able in a rather extensive review of the literature to find record of only 841 cases. A review of the literature since that time fails to show a marked increase in the report of cases: Gibson (2), Mayer and Welken (3), Michelsson (4), Ponomareff (5), Beall (6), and others, have made recent important contributions to the subject.

The kidneys seem to be as well if not better protected from injury than the other abdominal viscera; yet they are frequently injured in case of abdominal contusion. The fact that there are two kidneys, of course accounts in a large measure for this frequency.

A theory as to the cause that may explain a majority of the cases is that of Kuester, in which the rupture is supposed to be due to hydraulic pressure acting through the full vessels and the pelvis of the kidney which causes the organ to burst along lines radiating from the hilum toward the point of maximum impact against the lower ribs, the opposing resistance being supplied by the vertebral column.

Abdominal contusion most liable to cause damage to viscera is that in which there is a sudden, strong, impact against the anterior or lateral abdominal wall. This occurs usually when the patient is taken unawares, and the abdominal muscles do not have time to contract in self-defense; such contusions may be inflicted by a fall against a sharp object; or blows from a hoof, a fist, a thrown ball, a carriage pole, or a piece of wood from a circular saw. Indirect injury such as a fall upon feet or buttocks, may cause rupture. Even muscular action alone may be followed by rupture. This usually occurs in a pathologic organ. Wade (7) recently reports a case of spontaneous bilateral rupture in acute parenchymatous nephritis.

Thirty cases of spontaneous rupture have been reported due to arteriosclerosis, inter-

stitial, acute parenchymatous nephritis, neoplasm, tuberculosis, abscess, stone, infarcts, polycystic and solitary kidney. Another type of injury, such as being run over by a wheel, or crushed between car-bumpers, more often results in a complicated rupture.

A most important element in the recognition of these cases is attention to the history of the accident and the nature of the traumatism. Shock and collapse are often transitory, or may be absent; lack of recognition of this fact has been the cause of mistaken diagnosis and delay in proper treatment in a great many cases. Pain is usually severe at the time of the injury. It may be diffused, or localized in the kidney region. Its duration varies greatly, but it is usually present and is followed by tenderness and dull ache in the region of the ruptured organ. Rigidity of the muscles, with tenderness on palpation in the kidney region, is practically constant, and is of great importance.

Hæmaturia is generally present; it may be delayed in onset, or may occur with the first urination. It may be absent, in case the ureter is blocked with blood-clot, in case there is a transverse tear of the pelvis or ureter, or in case of complete pulpification of the organ. It must be remembered that hæmaturia following trauma may be due to injury to the urethra, bladder, or ureter, and when originating in the kidney may be due to causes other than rupture of that organ.

Tumor in the loin may be absent, may be present immediately after the injury, or may be a late development.

The diagnosis of a kidney lesion demanding an exploratory incision may generally be based on a history of particular abdominal contusion, with rigidity, tenderness or tumor, and hæmaturia.

Treatment may be expectant or operative. In Watson's series with expectant treatment 27 per cent of the simple ruptures resulted fatally. Radical operative treatment, that is, nephrectomy, resulted in 22.5 per cent mortality in 132 cases of simple rupture (Watson's, 8, and Neilson's, 9, cases). Conservative operative treatment, that is, gauze packing, drainage, or suture, gave a mortality of 8.5 per cent in 107 cases. Of the 125 cases conservatively treated, gauze pack or drainage was employed 115 times, with 16 deaths; suture of the renal wound or wounds, 10 times, with no fatality.

The decision between expectant and operative treatment is a momentous one, as the fate of the patient often rests on this decision. Concerning the former Neilson says: "So-called expectant treatment is permissible only in cases in which the local symptoms are insignificant, constitutional symptoms absent, and slight hæmaturia, alone directs attention to the probability of renal injury."

Yet there are many severely damaged kidneys which, if left alone, will cause death or prolonged illness, in which the local symptoms are insignificant, the constitutional symptoms absent, and with but slight hæmaturia.

There may be no differential sign or symptom between slight injury and complete rupture; therefore, it would seem advisable to expose the kidney and arrive at a positive determination as to the extent of the injury in every case in which we can arrive at a diagnosis of injury of the kidney, and not guess at the seriousness or the triviality of the injury. By so doing a certain number of unnecessary exposures of the kidney will probably be made. On the other hand, a certain number of deaths will be prevented, and many prolonged illnesses and unsatisfactory results will be substituted by prompt and satisfactory recovery. As in certain cases it is impossible to separate the slight from the extensive injury it behooves one to treat all cases as though they were serious until they have been proved to be otherwise. That this view is not taken by all is shown from the discussion of my paper at the Western Surgical Association in 1910, from the writings of Ponomareff, Frank, Michelson, and others who advocate the non-operative treatment and advise operation only when necessary to save life and when it is reasonably certain that complete recovery may be obtained in no other way. On the other hand Beall concludes that, except for cases of mild degree, early operation for rupture of the kidney must be considered a life-saving measure.

All operations for rupture must be ex-

ploratory at the onset, and may then be either radical or conservative depending upon the conditions found. Nephrectomy has in the past been employed quite extensively, but, from the experiments of Dolgoff (10) and from the clinical evidence of exploratory nephrectomy and the frequent, satisfactory recovery after conservative measures, it would seem that packing, draining, or suture might be more frequently substituted for nephrectomy. Gauze packing or drainage is the most common method of conserving damaged kidneys, having been employed 115 times in 125 cases in which conservation was attempted.

Primary suture has been performed on but few occasions though it is the ideal method of dealing with such injuries. Watson was able to collect reports of 8 cases and Neilson added 2 that were treated in this manner, In my article in 1910 I was able to find 3 additional cases in the literature which with the personal case reported made a total of 14 instances of primary suture of ruptured kidney. In the present contributions to the subject I am able to report 2 additional cases. Thus we have record of 16 cases of primary suture of kidney for rupture, with no death and only two unsatisfactory results. In one (Delbet) a secondary nephrectomy was necessary, and in the other (Watson) a fistula resulted.

In every case the sutures, when placed, caused satisfactory hæmostasis. In one of Griffith's cases, that of a man aged 48, the mattress sutures pulled through the very friable organ, and the fibrofatty capsule was sutured, inclosing the kidney as in a bag, with a satisfactory outcome. Dolgoff found that wounds of the kidney healed much more rapidly if the capsule was preserved, and especially if its cut edges were united. In one, my own case, the capsule of the upper third of the organ could not be united, yet the result was entirely satisfactory.

In another the fatty capsule was utilized as a hæmostatic and answered the purpose admirably.

In Fredet's case the patient had a nephritis and it was for this reason that nephrectomy was not done. As a consequence of the most encouraging result in this case, Fredet in his enthusiam says: "Nephrectomy is indicated as a late operation only where there is widespread infection."

A brief synopsis of my personal cases is here appended:

CASE 1. M. R. (Already reported in *Journal of the American Medical Association*, March 25, 1911.) A school boy of 11 years fell from his bicycle, striking the lumbar region against the curbing. He was able to walk home, but developed pain, tenderness, rigidity, and hæmaturia. Operation 36 hours later consisted of suture of stellate tear; recovery.

CASE 2. M. A. A little girl aged 5 years fell and struck her side against fence. I did not see her until ten days after injury at which time there was a distinct tumor in the kidney region, with a history of hæmaturia following the injury. There was at this time no blood in the urine. Incision revealed a distended capsule, intact, containing urine and blood. The kidney was ruptured with its upper third, gangrenous, floating in the fluid, entirely free from the remainder of the organ. The ureter was torn; therefore there was no blood in the urine, and consequently nephrectomy was performed; uninterrupted recovery.

CASE 3. A. W. Baseball player aged 24 years, while "sliding home" was struck in the side by catcher's knee; he was nauseated, and had some pain, but played in field for two innings. Then nausea and severe pain, called for the administration of morphine and he was sent to the hospital. The next day he was better and wanted to leave the hospital but in the evening morphine was again necessary, for pain. On the morning of the second day, blood in urine and rigidity in the kidney region led to operation. The incision revealed rupture of the capsule, with hæmatoma and the kidney torn into three pieces by two transverse tears. These were sewn with chromic catgut, and followed by perfect recovery. At last reports he was again playing professional baseball.

CASE 4. Young man of 30 years, was struck in the back by an automobile, was thrown 20 feet, got up without assistance, drove six miles in buggy, and went without medical attention from midnight until morning. On the afternoon of the next day, blood appeared in the urine and he was brought to the hospital 28 hours after injury. Blood in urine with tumefaction, and rigidity in the kidney region led to incision which revealed a stellate tear of the kidney, which was sutured with catgut; prompt recovery followed.

Of these four cases of rupture of the kidney, 4 patients are living and all the kidneys were saved except the one in which a ten day interval was allowed to elapse between the injury and the operation.

CONCLUSIONS

1. Shock, injury to other organs, and external evidence of trauma, are frequently absent in subparietal rupture of the kidney.

2. History of abdominal contusion followed by tenderness, rigidity, and hæmaturia is sufficient to lead to a diagnosis of injury of the kidney.

3. Slight lesions and serious rupture of the kidney may not be differentiated by clinical signs or symptoms.

4. Exploratory incision will reveal the nature and extent of the injury.

5. Proof that there is an absence of serious rupture is called for, before instituting the so-called expectant treatment.

6. Nephrectomy should be reserved for very extensive injury of the organ or late cases.

7. Conservative treatment, preferably by suture, is indicated in the majority of early cases.

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BLEEDING NIPPLES[1]

By DEAN LEWIS, A.B., M.D., F.A.C.S., Chicago

THE clinical significance of a discharge from the nipple of a nonlactating breast has been variously interpreted. Saar, in an article published in 1907, found that a discharge from the nipple occurred frequently with cystadenomata. It was found in 31 per cent (15 out of 48) of the cases analyzed by him. In some instances it was the first symptom which attracted the patient's attention and for which the surgeon was consulted. The amount of secretion varied, usually coming out in drops, but when pressure was exerted it could often be forced out in a stream. It was watery, milky, or serohæmorrhagic; rarely pure blood.

A scanty, thin, sanguinolent discharge is usually regarded as suggestive of carcinoma; a mucoid discharge of a benign growth; and a markedly bloody fluid as of an intracanalicular papilloma. Bloodgood states that a discharge from the nipple, except during lactation, may be looked upon as a sign of a benign lesion and not as a symptom of cancer. If the discharge is serum or blood, this is a positive sign of an intracanalicular papilloma. In senile parenchymatous hypertrophy one can often express from the nipple a thick brownish material, the accumulation of degenerated epithelium. This the patient rarely observes. In a personal communication Bloodgood also states that he is inclined to think that many surgeons look upon a discharge of blood from the nipple as a sign of cancer.

The pathological processes associated with the discharge of a hæmorrhagic or serohæmorrhagic discharge from the nipple have many interesting features. The tumor most frequently associated with the discharge is regarded by some (Kaufmann) as rare, but most surgeons having considerable material can recall some few cases of bleeding nipples, most of which have never been reported or carefully analyzed. The pathological changes associated with this symptom have been so variously interpreted and have received such a variety of names — encysted medullary carcinoma, cystofibroma, villous carcinoma, and duct cancers — that it is often impossible to determine whether the lesion under consideration is benign or malignant. By some — Koenig, Saase and Greenough — the intracanalicular papilloma, by all odds the lesion most frequently associated with a discharge from the nipple, is regarded as distinct from abnormal involution, while Saar and

[1] Read before the Western Surgical Society, Des Moines, Iowa, December 18, 1915.

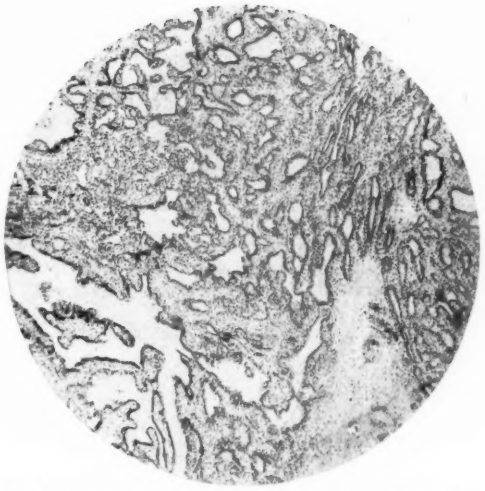

Fig. 1. Section of papillary cystadenoma situated in one of the larger ducts near the nipple. The cyst was the size of a hazelnut. When pressed upon this cyst could be reduced in size, and a stream of a serohæmorrhagic fluid, at times of almost pure blood, could be forced from the nipple. There had been an intermittent discharge of a serohæmorrhagic fluid from the nipple for eight years. A tumor situated superficially just to the inner side of the nipple developed two weeks before the operation was performed. (See Case 4.)

Fig. 2. Section of an intracanalicular cystadenoma removed from a breast in which no tumor could be palpated. A serohæmorrhagic discharge from the nipple had been noted for eight months. The papilloma, not larger than a small pea, was situated deeply in one of the ducts. It was so small that it could not be palpated. (See Case 6.)

Tietze consider this type of papilloma as intimately associated with or a part of abnormal involution, and consider the two together.

I have observed clinically seven cases of bleeding nipples, five of which have been operated upon. One case had been operated upon previously and several cysts removed. A discharge from the nipple subsequently developed in this case, but no operation has been performed up to the present time. The following histories indicate the course of the disease associated with the discharge and the pathological findings.

CASE 1. Mrs. W., aged 42. Married but never pregnant. One sister has had a radical removal of the left breast for carcinoma; lately there has been a recurrence in the scar. Five years ago I operated upon Mrs. W. and removed two small cysts from the left breast and one from the right. These cysts, the largest of which was the size of a walnut, contained a thick milky fluid. When examined histologically, the cyst-wall which was composed of thick fibrous tissue, was found to be lined by a layer of degenerating epithelium, which in some places had almost disappeared. Three years after these cysts were removed a milky discharge from the left nipple was noted. This continued for about one year. One year later a watery secretion was noted from the right nipple. Last January this discharge became serohæmorrhagic in character, the amount of blood being increased by manipulation of the breast. During March, April, and June, no discharge was noted, and during the past three months there has been none. The milky discharge has gradually grown less in amount, until at the present time there is very little. There has been no distinct tumor or cyst formation associated with the cessation of the discharge.

The diagnosis of senile parenchymatous hypertrophy was made when the cysts were removed, some small cysts being found adjacent to the larger ones. When I examined the patient last Spring a serohæmorrhagic discharge from the right nipple was noted, and a somewhat milky discharge from the left. A careful search was made for a tumor beneath the left areola, but none could be found. A secretion could be expressed from the nipple when the breast was manipulated, but no definite tumor could be found, although the breast had the peculiar shotty feel of microcystic disease. Operation was refused by the patient. Subsequently the discharge stopped, apparently without the filling of a cyst, as might have been expected if a duct containing a papilloma had become occluded. There is no clinical evidence of any malignant change in the breast. An operation is undoubtedly indicated,

but I believe that a plastic resection of the breast rather than removal should be attempted.

Case 2 is considered with the preceding because both are apparently examples of abnormal involution associated with a serohæmorrhagic discharge from the nipples.

Case 2. Mrs. A. T., aged 37, was admitted to the Presbyterian Hospital February 11, 1915. She has given birth to three children. It was noticed that the clothing covering the nipples was blood-stained in June, 1914. Shortly after this the patient became conscious of an itching sensation about the nipples, but did not know whether there was any relation between this and the bloody discharge. September 7, 1914, she consulted a surgeon who advised that both breasts be removed, a radical operation being advocated. A second physician advised that nothing be done for three months. During September and October the bleeding seemed to be more profuse and was great enough to show through the clothing. During the past few months the discharge has not been very profuse. There has always been more discharge from the left than right nipple. The itching sensation has been more marked about the right nipple. Both breasts are rather large. When palpated they have the shotty feel of microcystic disease. A serohæmorrhagic discharge can be expressed from the nipples when the breasts are palpated. No single cysts beneath the areolæ can be felt.

An operation consisting of a plastic resection was performed upon each breast, through a curved incision made on the median side of the areola. The entire glandular substance of the breast was removed through this incision. The glandular tissue was fairly riddled with small cysts varying in size from a buckshot to a cherry. Some of the cysts had a milky, other serohæmorrhagic contents. No distinct papillary growths could be seen on gross examination. Because of the peculiar granular feel of some of the cysts a careful histological examination was made of tissue removed from different parts of the gland in order to be sure that there were no malignant changes.

Microscopic examination revealed distinct evidences of papillæ formation. The epithelium in many of the cysts was grouped to form definite papillary growths supported by a connective-tissue stalk. This is a form of the adenocystic type of chronic mastitis. The same process results in the formation of papillomata in the ducts the growths most frequently associated with a serohæmorrhagic discharge from the nipple.

Case 3. Mrs. A. D., aged 51. Patient had given birth to one child. Nine months before entering hospital she sustained a slight injury of the right breast. Four months later she noticed a nodule in the breast, located superficially, about one inch above the nipple. During the last three months there has been at times a discharge from the nipple. At first this was serous in character. Later it became tinged with blood. The discharge is intermittent. There may be intervals of ten days or more during which there is no discharge. Then the nodule in the breast enlarges and there is a sensation of fullness. When the discharge is poured out the nodule decreases in size and the sense of fullness is lost. The nodule is tender on pressure. There is no spontaneous pain.

The nodule is the size of a hazelnut. It is situated beneath the areola above the nipple. When this nodule is pressed upon a serohæmorrhagic discharge can be expressed from the nipple. At the time the patient was examined the discharge consisted almost entirely of pure blood, which could be expressed, drop by drop, when the nodule was pressed upon.

A radical operation was performed in this case because of the suspicion of malignancy. When the nodule was incised a distinct intracanalicular papilloma was found. The base of this cyst has a distinctly granular feel and appearance, differing from the intracanalicular papillomata about to be described.

Upon histological examination, it was found that the epithelium had broken through the basement membrane at some points. Malignant degeneration of the papilloma had already occurred, but the operation had evidently been performed at a very early stage of the malignant change.

Within a year a large mass developed rather suddenly in the left breast, which was removed at another clinic. There were no microscopic evidences of malignancy in this breast, which represented the cystic type of chronic mastitis. This patient was operated upon in the spring of 1911 for the malignant papilloma and there has been no recurrence of the growth.

Case 4. Mrs. N. W., aged 46, was admitted to the hospital April 13, 1914. For eight years she had noticed an intermittent discharge from the left nipple. The discharge had recurred every four or six months. For nine weeks before entering the hospital the discharge had been almost continuous. Two weeks before entrance she noticed a tumor about the size of a hazelnut, situated superficially beneath the areola to the inner side of the nipple. This tumor developed rather quickly. The general examination revealed nothing and the remaining history has no bearing upon the subject under discussion.

A serohæmorrhagic discharge can be expressed from the left nipple when pressure is made upon the small tumor above mentioned. The tumor could be reduced in size by pressure and the serohæmorrhagic discharge became more bloody when pressure was made. The tumor was not adherent to any of the surrounding structures and could be easily displaced. The examination of the breast was otherwise negative. No cysts or irregularities could be found in the right breast.

A radical operation was performed. Upon sec-

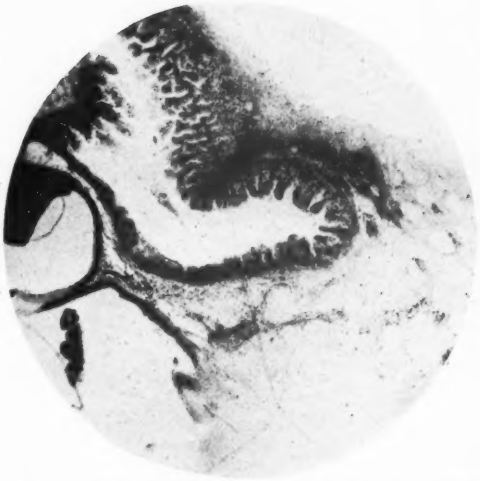

Fig. 3. Section through the acinus of a breast on which a plastic operation was performed. The papillary formation is very marked. The breast presents the typical changes of adenocystic disease. Hæmorrhage is associated with papillary growths whether occurring in the acini or ducts (see Case 2). Compare with following section from a breast upon which a plastic operation was performed for abnormal involution in which there was no discharge from the nipple.

tion of the tumor, a typical intracanalicular papilloma was found. There were no evidences of malignancy. A gross examination of the other parts of the breast revealed none of the changes associated with abnormal involution and no other papillomata.

The patient has remained well since the operation, and as far as can be learned there have been no changes in the remaining breast.

Figure 1 indicates the histological picture of this typical intracanalicular papilloma. Irregular tortuous openings and spaces are found and there is apparently an attempt to form ducts and acini. Club-shaped processes project into some of the larger spaces. These are covered by epithelium supported upon a connective-tissue stalk, the ends of which in some instances are rather thick. They are so thick in some instances that the villus-like projection might easily break off and thus give rise to bleeding within the duct. The glandular type of epithelial reproduction is not always preserved and in some instances there might be a suspicion of carcinoma, for the bases of the villus-like ingrowths are in some places so thin that it is difficult to determine the exact limits existing between epithelium and connective tissue.

The two following cases are examples of bleeding nipples in which no tumor could

Fig. 4. Section through an acinus of a breast upon which a plastic operation was performed for abnormal involution. The epithelium lining the greater part of this acinus has disappeared. The remaining epithelium shows marked degeneration. The contents of the distended acinus was milky. There was no discharge from the nipple.

be palpated, but during the operation a small papilloma was found within a milk duct, deep in breast tissue.

Case 5. Mrs. C. F., aged 35. Never pregnant. Was admitted to the Presbyterian Hospital May 12, 1914. She had noticed a discharge from the left nipple for some weeks. At times this was serous in character, but often became blood stained. The discharge varied considerably in amount and at times almost entirely ceased. There were no other symptoms. The breast was not perceptibly enlarged and no pain was complained of. Upon palpation no distinct evidences of a tumor could be found and the breast did not have the shotty feel of adenocystic disease. When pressure was made over the upper and outer quadrant of the breast, a serous fluid could be expressed, and the fluid became blood stained if the pressure was continued.

As no definite tumor could be found, the upper and outer quadrant of the breast was resected, as pressure over this quadrant caused the nipple to discharge. As one of the larger ducts was cut across near the nipple a serohæmorrhagic discharge was noted and deep down in this duct was found a small papilloma about the size of a small pea. As far as could be determined by gross examination there were no changes in the rest of the tissue removed and there has been no recurrence of the discharge since the operation.

Case 6. Miss M. B., aged 38, was admitted to the Presbyterian Hospital November 16, 1915. She had noticed a discharge from the right nipple for ten months. At times the discharge had been great enough to soil a rather large breast covering in 24 hours. No distinct pain had been noticed.

Neither breast was enlarged. No definite tumor could be felt, but the discharge could be increased in amount when pressure was made over the upper and outer quadrant of the right breast. A plastic resection of the breast according to the Warren method was performed. When one of the large ducts was cut across near the nipple a serohæmorrhagic discharge escaped. Situated deeply in this duct was a small intracanalicular papilloma (see Fig. 2) such as that described in Case 5. There were some evidences of beginning microcystic disease upon gross examination, but the changes were not nearly so marked as would be inferred from the findings revealed by palpation of the breast.

CASE 7. This case has been offered me by Dr. Carl B. Davis, who has had the patient under observation for some time. Mrs. C. F., aged 48, noticed last September some bleeding from the left nipple. The discharge was slight, but was enough to stain the underclothing. The bleeding soon stopped and now there is only an occasional watery discharge. No tumor could be palpated in the breast and there were none of the changes associated with cystic mastitis. The clinical findings in the breast corresponded to those in Cases 6 and 7, and the probabilities are that in this case the lesion is an intracanalicular papilloma which is so small and deeply situated that it cannot be palpated. Owing to the fact that the discharge is only occasionally observed and has become watery, the patient has refused to have any operation performed upon the breast.

These seven cases all presented a typical serohæmorrhagic discharge. The discharge in two of the cases at times became almost pure blood. In two cases the discharge was associated with chronic cystic mastitis, while in the remaining five small intracanalicular papillary cystadenomata were the cause of the hæmorrhage.

Saase in an article upon cysts and cystic tumors of the mammary gland states that the papillary cystadenomata are not related to carcinomata for the adenomatous new-growths do not infiltrate the surrounding tissue and do not extend beyond the walls of the duct which become dilated to form the wall of the cyst in which the papillary cystadenoma lies. As these growths are frequently situated superficially it is quite possible that the skin covering them might become ruptured or thinned so that the growth might extend externally; then a small mushroom or cauliflower-like mass is formed from the papillary cystadenoma. This has happened in some cases in which a cyst situated superficially has been incised and the growth not removed.

The important question regarding these cysts concerns their relation to malignancy. It is difficult to determine how many cases become malignant, for many of the cases, undoubtedly benign, were formerly regarded as duct cancers, and the cases were not followed subsequently, so that it cannot be determined whether recurrences occurred or not after operation. Bowlby and Mastermann report three local recurrences in sixteen cases collected or observed by them, but these were local, and were the result of an incomplete operation, rather than an evidence of malignancy.

In a personal communication Bloodgood makes the following statements concerning a discharge of blood from the nipple. His cases are divided into the following groups:

Group A: Cases in which women have had discharge of blood from the nipple without the findings of any tumor. This group can be divided into two classes. Class 1. Two cases have been operated upon. The breast was removed in these two cases and a simple papillomatous cyst containing blood found. One case was operated upon fifteen years ago, and the other five years ago. Both patients are well, without recurrences. Class 2. No operation was performed. He has had about five or eight of these cases. In all but one the blood has disappeared, no tumor has developed and the patient has remained well. In one case a tumor developed three years later and was removed. It was a cyst with a papilloma and there has been no recurrence after a period of about two years.

Group B: Discharge of blood from the nipple associated with a papillomatous tumor. All of these cases have been operated upon and in all a papillomatous cyst has been found. The majority have been benign. He thinks that in only one or two cases which were malignant was there a discharge from the nipple. From this experience he finds that discharge from the nipple alone is not an indication for operation.

Greenough and Simmons reported 20 cases of papillary cystadenomata of the breast in 1907. In eleven of these there was a serohæmorrhagic or hæmorrhagic discharge from the nipple. Three were malignant, but there is no mention made of a discharge in these three cases. There was one local recurrence in this group. The tumor recurred in the

same situation from which one had been removed and had persisted for four years as another operation had not been attempted,

Rodman regards papillary cystadenomata as an advanced stage of abnormal involution and states that they can usually be differentiated from cancer in a clinical way, because cystadenomata are nearly always situated immediately behind the nipple. The discharge of pure blood, the central location of the cyst, the age of the patient usually forty-eight or forty-nine years on an average, will enable one to recognize it. But Rodman believes that these are potentially malignant from their inception and that a radical operation should be performed. He has found but two exceptions. Of the six papillary cystadenomata that he has operated upon and has records of, four were definitely malignant, two were not. Rodman also reports two cases of bleeding nipple associated with chronic mastitis.

Histological interpretation of the cellular picture presented by a papillary cystadenoma is often difficult. This is indicated, as previously mentioned, by the reports of earlier observers who regarded these as duct and villous carcinomata. If they were carcinomata there have been relatively few recurrences even after incomplete operations.

The character of the discharge, whether serohæmorrhagic, hæmorrhagic, or brownish, apparently gives no clue whether malignant changes are occurring. Some of the benign papillomatous growths have been associated with a brownish discharge. In some instances the discharge has lasted as long as nine years, in one case as long as twelve. One of the cases observed by me showed beginning malignant changes. In this case a discharge had been noted for three months, but a tumor had been present for four. The character of either the discharge or of the tumor did not enable me to make a diagnosis of beginning malignancy as they did not differ from those of a benign papillary cystadenoma. The granular wall of the cyst aroused suspicion of malignancy when the cyst was incised.

Bleeding nipples are most frequently associated with intracanalicular papillary cystadenomata and the adenocystic type of chronic mastitis. The papillary growths occurring in the acini or ducts are essentially the same and the papillary cystadenomata should be regarded as a part of abnormal involution, although not necessarily as a late stage. That the papillary cystadenoma may not be single is indicated by Saase's report. In only one of five cases observed by him were there no evidences of changes in the breast with the exception of the cyst. Even in this case a statement cannot be made concerning the portion of the breast which was left, for only a small part of the breast immediately adjacent to the papillomatous cyst was removed.

A plastic operation should be performed in most of these. It should be performed, unless there are evidences of malignancy. The changes associated with malignant degeneration, I believe, are quite definite and can be determined by gross appearance when such a cyst is opened. I believe that an operation should be advised even when there is no evidence of a tumor for in these cases a small intracanalicular papillary cystadenoma will be found deep down in the ducts. The portion of the breast in which the growth lies can be determined by the increase of the dicharge when pressure is made.

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DERMOID TUMORS OF THE MOUTH

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THE submental dermoids, those situated below the mylohyoid muscle, and the sublingual dermoids, those developing between the genioglossi and the geniohyoid muscles, at times offer difficulties of diagnosis especially if the tumor has attained any considerable size, when the source from which it originated may be impossible to determine. The larger number are found in the latter position, at times extending deeply into the substance of the tongue and accompanied by a greater or less degree of deformity of that organ.

To the presence of a submental dermoid is due at times the condition of a double chin, the extent of the chin depending upon the size and shape of the cystic growth. The skin overlying such a growth is not changed or immobilized, the tumor mass itself presents a smooth, regular surface, is painless, and on firm pressure gives one the sensation of feeling a bag of putty. This doughy mass pits under firm pressure with the finger tip. Unless this variety of tumor has attained considerable size it can be appreciated through the mouth only by pressing upward below the growth which brings it into view beneath the tongue.

The sublingual variety of dermoid on the other hand is first made out through the mouth and it is only when this tumor has attained a size of several centimeters that it may evidence its presence submentally. When either variety has attained a size of eight or ten centimeters it is difficult, if not impossible, to determine whence the growth originated, the deformity manifesting itself both within the mouth and below the chin. The enlargement in the latter type of dermoid never manifests itself to the same extent below the chin as does the submental tumor.

The mucous membrane over the sublingual dermoid is freely movable and does not present the grayish color or transparent appearance peculiar to ranula, although the same symptoms as those of a ranula may be present due to the mechanical disturbances produced by the growth. These symptoms include speech and respiratory disturbances and later difficulty in swallowing as the displacement and interference with the movements of the tongue become marked. At times it is impossible to distinguish between a dermoid of the sublingual variety and a ranula, although the color and transparency of the latter and its position more to one side of the median line are suggestive of ranula, as is the doughy feel and pitting on pressure more suggestive of dermoid. A dermoid of this locality may present to one side of the median line though not often.

Dermoids of the mouth are usually met with in adult life in spite of the fact that they are congenital structures. This is due to the fact that the growth is slow and painless and attention is not called to the cyst early unless there is some difficulty in nursing on the part of the child.

The case here pictured (33060, F. Y., 1915) occurred in a Filipino aged 26 years, married and a housekeeper, who came to the clinic at the Philippine General Hospital complaining of a swelling in the neck and under the tongue which caused difficulty in talking and almost entire inability in swallowing.

The patient's family and past history is of no importance nor, on routine examination, did any other abnormality present.

The first intimation of any trouble the patient had was about ten years before coming to the hospital at which time a small rounded swelling under the tongue was felt. The patient at first believed this to be a boil but no pain was felt and the swelling has continued to enlarge gradually till the present time.

Examination shows a well developed but poorly nourished woman. As is seen in the accompanying photographs the patient is unable to completely close her mouth owing to the size of the cyst which fills the oral cavity nearly completely, pushing the tongue upward and backward until only the tip of the latter may be seen when it is protruded as far as possible (Fig. 2).

The tumor was immovable, smooth, of a doughy consistence, and connected with neither the skin of the neck and chin nor the overlying buccal mucosa. The opaque bluish color seen in ranula was not present over the portion of the swelling

Fig. 1. Dermoid cyst.

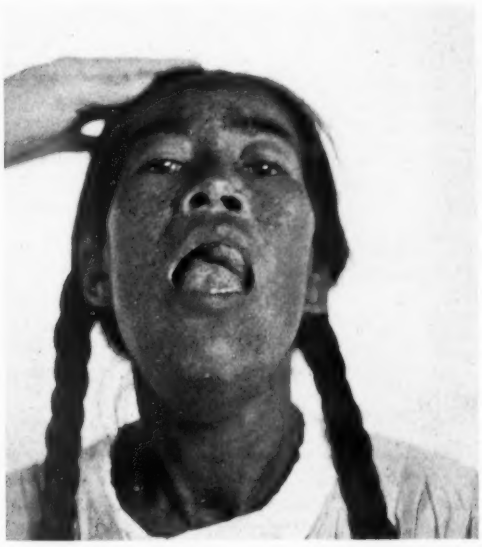

Fig. 2. Dermoid cyst. Tongue protruded as far as possible.

presenting in the mouth, there being little change from the normal color of the mucous membrane covering. An attempt to aspirate the cyst was unsuccessful even though a large needle and syringe were used.

An incision along the median line over the greatest curvature beneath the chin was made and shelling out the cyst attempted. This was found impracticable on account of the intimate relation existing between the cyst wall and the surrounding tissues, so the cyst was opened and several ounces of typical dermoid content evacuated—thick, putty-like, whitish material of a semicrystalline structure readily soluble in ether. As much of the wall of the collapsed cyst was removed as could be readily detached, the remaining portion was cauterized with carbolic acid and the contracted cavity packed with gauze.

Recovery was uneventful, the gauze being removed as the cavity contracted, and healing occurred promptly, with a complete return of function of the tongue and mouth floor. The patient gained in weight as it became possible to increase her diet.

HEREDITARY SYPHILIS AS AN ETIOLOGICAL FACTOR IN SPURS ON THE OS CALCIS

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SINCE attention was first drawn to exostoses or spurs on the plantar surface of the os calcis as one of the relatively common causes of foot disability, their etiology has been shrouded in mystery, their treatment an embarrassment to the surgeon.

Blencke who studied six hundred normal individuals found that spurs were present on the os calcis in 2.8 per cent of the cases. Very often they give no symptoms until some trauma occurs, such as falling and striking on the heel.

Murphy (1) in presenting a case in a recent number of his *Clinics*, states that such formation is the result of some constitutional toxin. He refers to the idea prevalent in France that many exostoses are due to gonococcus infection, though he also thinks that probably there is a variety of causes. In the case under discussion he reports that tuberculosis as the causal agent was excluded by the fact that the patient did not give a focal reaction to tuberculin though he gave a marked constitutional reaction. No mention, however, is made of the possibility that syphilis in any form may be an etiological factor.

Meisenbach (2) in a very careful article presents the results of his observations in twenty cases. From the history and X-ray findings he concludes that the cases can be grouped into one of four types; namely, infectious, traumatic, syphilitic, and osteoarthritic. In the discussion of this paper Hoffman expressed the opinion that these spurs were merely the result of a general inflammatory process of the os calcis or of the os calcis and other bones. Cone and Ryerson (2) both called attention to the fact that operative removal was often unsuccessful because of the recurrence of the spurs, and they seemed to believe that this recurrence was due to hyperæmia of the os calcis at the site of the spur formation, following the trauma of removal. Murphy (1) believes that an accompanying bursitis is the cause of the pain rather than the spur *per se*. No one who discussed Meisenbach's paper made any reference to his suggestion that syphilis might play a part. It is frequently mentioned that relief cannot be obtained by removal, if the accompanying bursa is not excised as well. The operative treatment, however, was not universally recommended by Meisenbach (or by those who discussed his paper), the idea being that protection should be first attempted.

The present paper is based on a study of nine cases, in three of which the symptoms recurred after temporary improvement, following the removal of the spurs. In the other six, no operations were performed. The diagnosis was confirmed in seven cases by X-ray negatives.

As the result of the study of these cases of spur formation, it is our belief that hereditary syphilis is responsible for many of these exostoses. As will be apparent, the study of the family history suggests lues more frequently, perhaps, than does the examination of the patient himself, who rarely presents any obtrusive signs of hereditary lues; though a very careful examination will often reveal something that is suggestive. It will also be observed that the Wassermann test was negative in all the cases.

Case 1. A man aged 33 had always been in good health except for a Neisserian infection a good many years ago. Three years previous to examination he began to feel pain in his heels. This pain persisted in spite of various therapeutic measures. Finally the true nature of the condition was revealed by X-ray pictures. The spurs were thereupon removed, but the pain recurred.

As the patient had had gonorrhœa our first

thought would naturally be that this was the cause of his trouble. He was a very robust, well nourished man, and presented no signs of hereditary syphilis except that his tongue contained many deep and irregular fissures. The skin of the whole body was exceedingly dry, which condition had been present also in at least two other generations. His mother and one brother were living and said to be well. The possibility of hereditary syphilis was suggested by the fact that his father died at the age of 53 of Bright's disease. A high percentage of individuals who die a cardiovascular-renal death, in middle life, are infected with syphilis and their children frequently have some manifestations of hereditary lues. The Wassermann reaction was suggestive only (one plus, 25 per cent inhibition), though the leutin test was very positive.

Although all his old symptoms recurred within a few weeks after the removal of the spurs, his improvement under injections or mercury, iodide of potassium, and salvarsan has been very marked.

CASE 2. A young man of 20 first noticed pain in his left heel about two years ago as he was walking. As he was a clerk at this time he attributed it to being on his feet. The soreness, however, constantly increased. Of late he has noticed pain in his knees and hip-joints. When seven years of age he had an attack of "rheumatism" at which time the knees and ankles were swollen. He also had some pain in his hips and occasionally in the shoulders; this attack was of several months' duration. Fourteen years ago he again suffered from "rheumatism" in his hips and knees. This attack lasted about a year. Several years later he again suffered from an attack which was of three or four months' duration. In all, he has lost nearly three years of school work, because of his "rheumatism" attacks.

He had never had any venereal disease. His mother and one sister are living and appear to be well. His father, however, died at 58 of apoplexy. Aside from being a sallow, poorly nourished individual, whose teeth have been neglected, his physical examination was negative, except for the left heel which was swollen, tender but not reddened, on the posterior and under surfaces.

Spur formation on the os calcis was demonstrated by the X-ray picture. No operative measures were undertaken, as he gave a positive luetin test, though a negative Wassermann. He was put on weekly (1 gr.) injections of salicylate of mercury, and iodide of potassium, and later he received one injection of salvarsan.

On August 31, 1915, at which time he had been under treatment exactly nine months, he stated that he had been working as a clerk all summer long and had been constantly on his feet without discomfort. One year ago he was not able to stand up continuously for one-half hour, because of pain. He experiences no pain now, except after a long tramp, when he has slight pain across the upper part of his heel.

CASE 3. A widow of 38, whose husband had died from pneumonia, complained of painful feet. Her father died at 46 of "shock." Her mother at 50 of "smothering" spells. She had one child which is said to be well, and has had no miscarriages. Many of her teeth were black and eroded on their labial surface. This condition had prevailed since childhood. This discoloration, generally attributed to medicine, is usually due to hereditary lues. Figure 1 shows the X-ray findings. This patient had been operated upon six months previous to this note and the symptoms had recurred. The leutin test was strongly positive, so it was deemed advisable to put her upon specific treatment before operating again. For the first three weeks of treatment with potassium iodide and salicylate of mercury, no improvement was noticed; as a matter of fact, the patient complained because she had pain and stiffness in her hands and her right elbow, which had previously given her no trouble.

Shortly thereafter, however, definite improvement was noted and six weeks later she had substituted a number six shoe for a number eight, which she had been compelled to wear for the past four months. She still favors her heels slightly, when walking, but has made very definite improvement.

CASE 4. A boy of 19, with a negative family history, who had had no venereal disease, first noticed pain like "knives in his feet" some eighteen months ago. This was so severe that it interfered with his work and the removal of spurs which were found to be present (Fig. 2) did not give the desired relief. He was unhealthy in appearance and the only thing at all suggestive in the physical examination of hereditary syphilis was the fact that the right upper lateral incisor was very small and the left upper was lacking. As the patient has no recollection of losing this tooth, it is probable that it never erupted. While not the sole cause of the dental dystrophies and hypoplasias, hereditary syphilis appears to be by far the most common etiological factor. A Wassermann was not made, but he gave a strongly positive luetin test.

Improvement promptly followed mercury injections and the administration of potassium iodide. He is now walking to and from his place of work, which is a distance of about one mile, with comparative ease. His mother recently said that he no longer had pain in his heels.

CASE 5. A man of 46 had enjoyed good health up to eighteen years ago, when he began to suffer from "rheumatism" in his hands and feet, but especially in the latter. About a year ago the "rheumatism" in the feet became much worse and has been nearly constant since then. He was compelled to give up his occupation, which necessitated being on his feet constantly, because of this pain and weakness which would require the rest of a week or two after two days' work. Eighteen months ago an X-ray picture (Fig. 3) showed spurs on both heel bones. As the pain was especially marked in the heels, these exostoses were removed, but his symptoms returned after the operation. About seven months ago it

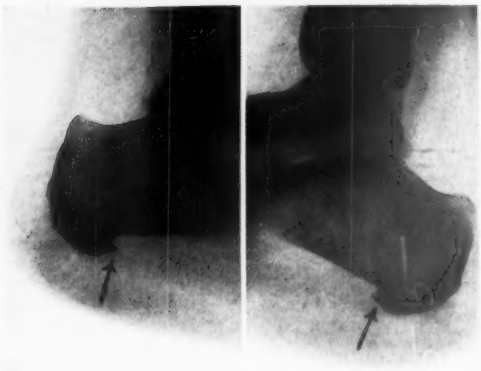

Fig. 1. Case 3. These sharp spurs were removed and the temporary relief was followed by a relapse which was entirely cured by specific treatment.

was discovered he had sugar in his urine, but it has not been present in several examinations since then.

A few years ago he drank to excess and twenty years previously had gonorrhœa. His father died at 62 of heart disease. Two brothers and a sister are living. The mother and one sister are said to suffer from "rheumatism." The patient's systolic blood-pressure is in the neighborhood of 165, and he has a harsh systolic murmur at the base of his heart. X-ray pictures show dilatation of the arch of the aorta and calcification of his tibial arteries. Reflexes and pupils are normal.

Both lower lateral incisors presented on their anterior surface, pin point areas of hypoplasia near their dorsal surface. Many of his sister's teeth are lacking and the remaining incisors are peg-shaped and they and the canines show the same hypoplasia which is usually due to hereditary syphilis.

His Wassermann reaction was negative; spinal fluid also negative; luetin very positive. There has been very satisfactory improvement not only in the "rheumatism" but especially in his general condition, since he has had several injections of salvarsan and mercury. He states he "feels better in every way." Six months after treatment was begun he was working as a waiter and said his feet were "first rate."

Three other cases of spur formation on the os calcis have presented themselves, and because of the interesting features in the family histories it is thought desirable to include them in this report, though sufficient time has not elapsed to definitely determine the results of specific treatment.

Case 6. A housewife, age 40, was seen September 24, 1915. She complained of pain in the bottom of both heels, present for six months, and had not been relieved by untiring efforts with supports, orthopedic shoes, and static electricity. Her father died of Bright's disease at 64. Her mother died of locomotor ataxia at 54. This patient, though she appears well nourished and robust, has perfectly white hair and says she has been ill all her life. She has suffered with repeated attacks of headaches ever since childhood. Her feet were slightly pronated, and exquisitely tender under the ossa calces. She has been provided with supports intended to remove pressure from the os calcis, and has been started on specific medication, which had hitherto been denied her because her Wassermann was negative. A luetin test was made in October, and it was positive. Specific treatment has been energetically pushed, and the family physician reported on December 15, that the feet were practically free from pain, and that the attacks of headaches, from which this patient had suffered all her life, were greatly lessened in number and frequency.

Case 7. A woman of 40 injured her right foot and ankle in September, 1913, and was seen in July, 1914. She said that the injury consisted "in a torn muscle in her leg" that this injury had not been fully relieved, and that she was unable to use her leg, because of continuous pain. The examination was entirely negative, except that the patient was prematurely gray and the leg was atrophied one inch. The Wassermann test at this time was negative, as it so often is in adults with hereditary syphilis. The symptoms persisting, this patient has recently been re-examined, and the left tibia presents anteriorly a cortical enlargement of the shaft, which, when fully developed, becomes the so-called "saber case" tibia. On the under surface of the left os calcis, there is a small spur (Fig. 4) which is quite painful. This patient's family history is as follows: Her father died at an advanced age, but had been lame for years and suffered from "growing pains" in his legs, so severely that he would have to walk the floor at night. Her mother died of diabetes. The mother's first child, a son, is insane;

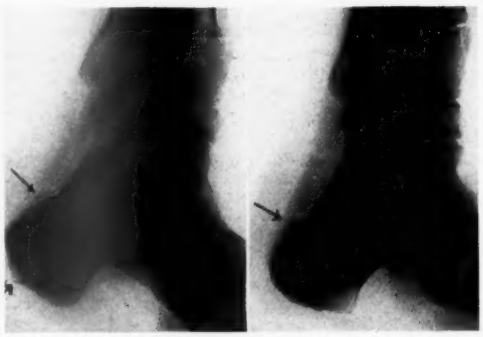

Fig. 2. Case 4. These large spurs were removed. The pain promptly recurred. The patient is now entirely well, after energetic specific treatment.

the second pregnancy was a stillbirth. The patient here described was the third child. The next child died of cholera infantum, and the last at 20 of "stomach trouble."

Active specific treatment was begun in October, 1915, and by the first of January, 1916, all the symptoms in the tibia, and in the os calcis had disappeared. The patient is now able to walk about without discomfort, though she had been confined to a wheel chair, and crutches for at least a year.

CASE 8. A housewife, aged 40, presented herself two weeks ago, complaining of "rheumatism" in her feet. Upon examination it was quite evident that this "rheumatism" consisted of the largest and most painful spurs imaginable. The family history contains much of interest.

The father is living and is 65. When in his forties he had such terrible "throbbing headaches" that he would have to go to bed for half a day. The mother is living and is 63. All her life she has suffered much from "rheumatism"; first of the left hand, then both knees. Five years ago, when 58 years old, a diagnosis of Bright's disease was made. She has been an invalid most of her life, as the result of "rheumatism." She was pregnant four times, the patient under discussion being the first child. The patient since childhood has suffered from Raynaud's disease, which has badly deformed the finger tips. At one time, when about 30, an obscure skin lesion responded to specific treatment. About two years ago she began to experience pain in her heels upon getting out of bed in the morning. It is for this condition, which had increased, that she came to the hospital. There is nothing to be detected in the woman's physical condition aside from her hands and feet. The distal half of all her fingers are of a purplish white, and the distal phalanges are short and stubby in appearance. The under surface of the heels is tender to the touch, and a bony growth can be felt.

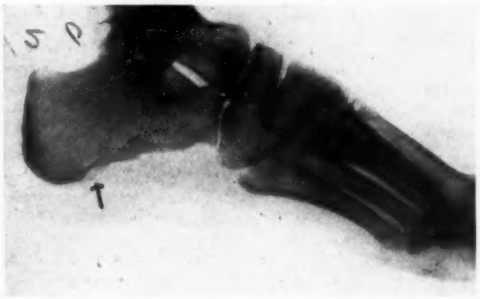

Fig. 4. Case 7. This spur occurs in company with a cortical thickening in the tibia.

Fig. 3. Case 5. The arrows indicate the spur formation on the under surface of the os calcis. Note particularly also the very slight beginning spur on the posterior surface of the right os calcis. The uppermost arrows indicate the highly sclerotic posterior tibial arteries present in a man less than 50 years of age.

The pregnancy succeeding this patient resulted in a miscarriage; the next in a living child, now 38, in good health, and she has three healthy children. The youngest sister, age 34, has had several attacks of nervous prostration. When a young girl she was subjected to severe "growing pains" and severe headaches. She is still subjected to sick headaches, accompanied by vomiting

The patient's husband is living and well. The patient has been pregnant six times: the first resulted in a "blue baby," which died 24 hours after birth; the second in a boy, living and well, age 7 years. The next pregnancy resulted in a miscarriage; the fourth in twins, living and well, age 5 years; the fifth, a "blue-baby," lived six hours; and the last pregnancy was a miscarriage.

Wassermann reaction was negative; luetin, plus.

The last case is of special interest because the family history suggests the possibility of syphilis in the maternal grandparents and

in one-half of the number of children in their family. The history is as follows:

CASE 9. A man of 36 was operated on for spurs on the os calcis in the Hartford Hospital, on September 26, 1915. He was better for a time, but the symptoms subsequently recurred, and he returned for relief of pain when walking, in October, 1915. He has always enjoyed first rate health, and there is nothing in his physical examination to suggest hereditary syphilis. Several years ago he had gonorrhœa, but no chancre.

His father is 64 years of age, and said to be in good health. The mother is 60, and she suffered a great deal from some illness at the "change of life," the nature of which is not clear. Some operation was performed.

For a number of years she suffered very much from severe headaches. The maternal grandfather died at 50 of liver complaint (syphilitic cirrhosis?), the maternal grandmother at 68 from a "stroke." The first stroke came at about the sixty-fifth year. She had ten children, one of whom died in infancy. Nine lived to grow up; two were mentally deficient, and had "fits," and died at about forty. Two living are mentally deficient; and another, who though not mentally deficient, is nevertheless subject to "fits." The mother of this patient, who is the second oldest child, has had fifteen children, all but one of whom are living. They are stated to be in good health but it has not been possible to examine any other member of the family for evidence of syphilis. The data, however, is very suggestive of syphilitic ancestors.

The X-ray picture made in October, 1915, shows a spur on the under surface of the os calcis, and appears to show that the spur on the posterior surface has enlarged since the first picture was made. Active specific treatment was begun at once, and on February 1, 1916, the pain on the under surface had ceased, and there was less pain on the posterior surface.

We realize that this series of nine cases is too small to warrant any definite conclusions. In all but one case, however, the family history was very suggestive of syphilis. The Wassermann test even with cholesterinized antigens was uniformly negative. It seems clear, however, that as the results of specific treatment were so uniformly conclusive, we are warranted in assuming that in these cases, at least, hereditary syphilis played an important part in the etiology. It is worthy of notice that in three of the cases a previous removal of the spurs was followed by a relapse, and that the symptoms were cleared up in each by specific treatment.

From our experience, therefore, it seems evident that certain cases of spur formation on the os calcis are the result of an inflammatory process, for which hereditary lues provides the underlying cause. The pain in such cases is occasioned by the inflammation, and disappears as the process subsides under treatment. It cannot be said, therefore, that the pain is primarily due to an accompanying bursitis, as was suggested by Murphy. Moreover, it would appear that the operative removal of such spurs of the leutic type is necessary only when they cause pain in adjoining tissues by their mechanical presence.

REFERENCES

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2. MEISENBACH, R. O. Am. J. Orth. Surg., 1912, ix, 457.

THYROID TUMORS OF THE BONES

With Special Reference to Non-Malignant Pulsating Tumors of the Skull

By J. PHILLIP KANOKY, M.D., Kansas City, Missouri

THYROID tumors of the bones are of two types: The first and most frequent are metastases of malignant growths of the thyroid; the second, thyroid tumors where the thyroid appears normal, or where there is a goiter of a clinically benign type. Some authorities deny the possibility of metastases of a normal thyroid or of a benign growth, and hold that in the cases reported, there was, in reality, a beginning malignant process which was but slightly advanced and so overlooked.

Other points to be noted are that although some of these thyroid tumors are pulsating, all are not and that other bone tumors, chiefly sarcomata, may pulsate; so that pulsation cannot be regarded as a characteristic symptom of these tumors. In fact, clinically they cannot be distinguished from other bone tumors, and their true character is revealed only on histological examination.

The following quotations from various recent authors indicate the present state of our knowledge of these tumors, and the points at issue.

Beilby, writing in 1907, says:

> There are now in the literature records of about 20 cases of tumors apparently metastases from the thyroid, which were histologically benign. As in a number of instances there has been no apparent thyroid lesion, these cases have been considered as metastases from normal thyroid tissue. Where a thyroid lesion has been observed it has been that of simple hypertrophy or adenoma, and the metastatic tumor has had a similar histological structure. These metastases, which may be single or multiple, have occurred most frequently in bone, and have often been removed under the supposition that they were primary growths. Aside from the fact that these tumors are probably of metastatic origin, they present as a rule no other indication of malignancy. Frequently, however, they have been known to recur after removal and a number of cases have thus resulted fatally.
>
> The fact that we have in these metastatic tumors structures similar to or almost identical with the tissue found in the normal gland lends special interest in the etiology of these tumors. In its consideration several factors may be taken into account.
>
> 1. Origin from misplaced embryonal tissue. The theory which has been advanced by Cohnheim in which he regards the etiology of malignant growths as due to misplaced embryonic cells might be applied to tumors of this class.
>
> 2. Origin from aberrant or accessory thyroid. Murphy . . . calls special attention to a group of accessory thyroid glands at the base of the tongue . . . . He records 39 cases[1] (of tumor).
>
> 3. Propagation of bits of thyroid tissue through the circulatory system. It is a well-known fact that certain tissues, especially young embryonal cartilage, when transplanted into different tissues of the body or when injected into the circulatory apparatus, are apparently nourished and in certain instances continue to grow. An apparently analogous condition is true of the thyroid gland . . . . Although no proof is at hand, it is possible that these metastatic tumors could result from small particles of thyroid tissues which had found their way into the circulatory apparatus and had been transferred to distant portions of the body. In an organ as vascular as the thyroid such a condition is not inconceivable, especially under conditions of trauma.

Dr. Blumer in his article on "Tumor Metastases in the Bone," says:

> The thyroid tumors which give rise to bone metastases present some very marked peculiarities. While some of them are very evidently malignant, judged from their clinical manifestations alone, others show none of the ordinary evidences of malignancy.
>
> An analysis of 62 cases from the literature shows that two-thirds of the thyroid metastases occur in women, and 90 per cent of the cases between the ages of thirty and seventy. No obvious clinical involvement of the thyroid is present in at least 25 per cent of the cases; when enlargement occurs it is often apparently an ordinary goiter which may have been present as long as thirty years before metastases appeared. It is important to note that metastases may not appear until three or four years after the surgical removal of the gland. Clinically, two-thirds of the metastases are of the solitary type, and even at post-mortem multiple metastases are the exception.
>
> So far as distribution of the thyroid metastases is concerned, 38 per cent of them occur in the bones of the cranium or face, 16 per cent in the vertebræ,

[1] These are not bone metastases.

Figs. 1 and 2. Photographs showing author's case.

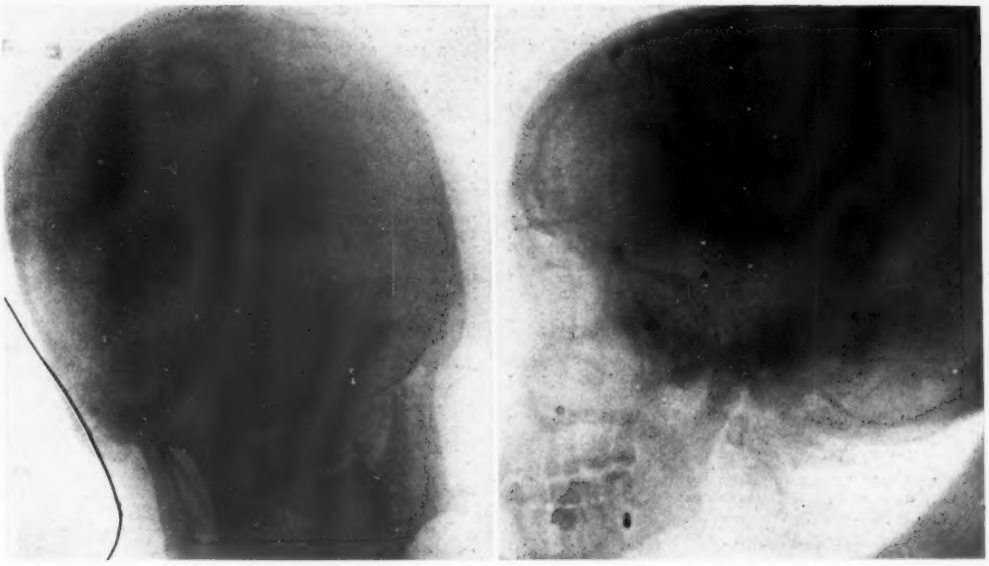
10 per cent in the femur, 9 per cent in the pelvic bones, 7 per cent in the sternum, and 5 per cent in the humerus. Of the facial metastases seven out of nine are in the lower jaw. Spontaneous fractures occur in 9 per cent of the cases, and the spinal type in 10 per cent. The slowness of the growth of bone metastases is in some cases most remarkable and makes them unusually favorable for surgical removal. In one instance, a tumor of the malar bone had been present for thirteen years, in another instance a tumor of the sternum had been present for seventeen years, and in still another case a tumor of the lower jaw had been present for ten years. Growth may be greatly accentuated by trauma or the metastasis may first appear with the trauma.

A very important fact in connection with the thyroid bone metastasis is that clinically no change in the thyroid gland may be detected even on the most careful scrutiny. It is true that detectable small tumors may be overlooked clinically simply because the thyroid was not thought of. In a case I saw with Dr. Turnbull in San Francisco there were large bony tumors of the clavicle and pelvis, and a perfectly definite tumor the size of a cherry in the right lobe of the thyroid without any enlargement of the neck. Still, when the tumor is the size of a pea, as has been reported, it is not surprising that it is overlooked.

Compared with some bone metastases, those from the thyroid gland frequently show a comparatively low grade of malignancy. As a rule thyroid bone metastases are exceedingly vascular and *some of them pulsate*. For this reason they have occasionally been mistaken for aneurisms, particularly those involving the sternum, pelvis, and skull.

Dercum says:

The question as to the malignant character of the enlargement of the thyroid gland in cases of metastasis, is one that cannot be regarded as settled. However, it is very suggestive that among the 18 cases collected by Patel, 13 were regarded as benign by the authors reporting them. In the remaining 5, the benign or malignant thyroid enlargement is not mentioned. In the present state of our knowledge the problem can only be answered in a speculative way. It appears that simple hypertrophy plays no rôle in the etiology of thyroid metastasis. Patel calls attention to the interesting fact that it is particularly in the colloid goiters that metastasis occurs. They especially present diffuse cellular proliferation and it is readily comprehensible how under such circumstances metastasis could occur. Further, goiters that are decidedly cystic present also vegetations in their interior and these may break down. That fragments should thus find their way into veins and capillaries, does not seem strange. Still, it is remarkable, inasmuch as colloid goiters are relatively common, that thyroid metastasis does not occur more frequently. Wolfer maintains that if a metastatic growth not only increases in size, but also takes on a destructive action of the bones, the primary tumors cannot be considered benign, not even when clinical, anatomical, or even



Figs. 3 and 4. Radiograms of author's case.

histological investigations have failed to establish their malignant character. . . . As Patel points out, if the metastasis be benign, we will observe the typical structure of the thyroid gland. . . . If, on the other hand, the metastatic formation be malignant, we will probably find side by side with normal thyroid vesicles, areas in which are found irregularly shaped cavities crowded with epithelial cells of the same type as those which line the vesicles, but irregularly arranged, heaped in rows of disorded accumulations.

Muller and Speese state that according to Ehrhardt [1] "metastasis is observed in 85 per cent of the reported cases of malignant goiter where an exact autopsy record exists." Ehrhardt gives 238 cases of malignant disease of the thyroid gland to which the above-named authors add 19. Of these there were metastatic tumors in the bones in 49 cases of carcinoma, and in 24 cases of sarcoma. The bones most frequently affected were those of the skull and inferior maxilla; next in frequency sternum, vertebra, rib, femur, humerus.

These authors say:

Metastasis to bone is not only a frequent but a very interesting complication of these malignant thyroid tumors, because this organ together with the breast and the prostate are practically the only ones in which metastasis to the bone is commonly observed. . . . Another peculiarity is the frequent presence in the metastatic bone tumor of colloid material contained in normal or abnormal vesicles, in practically all cases, of course, the primary tumor being a carcinoma not a sarcoma.

Regensburger in a recent article, August, 1912, says that he found record of 59 cases (besides his own) of thyroid metastases in the bone in which there were no symptoms indicating the malignancy of the thyroid, although many authors believe that such malignancy must exist before metastases can form. He holds, however, that it is possible, owing to the thyroid's close relation with the blood and lymphatic system, that cells of a healthy, or at least a non-malignant, thyroid may be transplanted to other parts of the body.[2] He does not review these cases in detail, so there is nothing to indicate how many of them were pulsating.

He also notes other cases (number not stated) of bone metastases in which there was a primary malignant growth in the thyroid, mostly carcinoma, in which the struc-

[1] Beitr. z. klin. Chir., 1902, xxxv, 243.

[2] See also case reports under 1912: Regensburger.

ture of the metastases varied from that of normal thyroid tissue to perfect medullar carcinoma.

He states that in his dissertation published in Strassburg in 1911 he reviewed the subject and the literature in detail, but this publication is not obtainable here.

Dr. Simmons says:

> There are seen at times solitary or multiple bone tumors which are composed of typical adenomatous thyroid tissue, and yet which are not necessarily accompanied by goiter. These tumors are most commonly seen in the sternum, vertebræ, humerus, and skull. As regards their origin there is considerable difference of opinion. Bormann, Oderfeldt, Steinhaus, and others consider them as being examples of metastasis occurring in a benign tumor, that is, a simple adenoma of the thyroid; while von Recklinghausen, Huguenin, and with them the majority of observers, consider them as metastases of a microscopic malignant thyroid tumor that has been overlooked; and there is nothing in the reported cases to disprove this. The possibility of their being in some cases embryonic inclusions is to be thought of. Von Eiselsberg in 1893, reported 8 cases, the tumors being multiple in 3 instances.

Simmons makes no mention of pulsation as a symptom of these tumors but he states that they are "very vascular," and in the same article, speaking of bone sarcomata, he says:

"A certain number of these tumors, *on account of their vascularity*, have a distinct pulsation." This would indicate that the thyroid tumors might also pulsate.

Sutton in the latest edition (1911) of his book says:

> The term general thyroid malignancy is applied to a rare but very remarkable form of disease, in which tumors structurally identical with the thyroid gland appear in the bones. The fact which invests them with more than ordinary interest is that they have, in nearly all instances, been associated with an obvious enlargement of the thyroid, which clinically is indistinguishable from the common kind of enlargement known as parenchymatous goiter. The earliest cases were observed by Cohnheim and Morris.
>
> Since 1880 a score of cases have been described, and from the records, the following facts may be stated:
>
> The tumors occur most frequently in women (five to one), and are most common between the fortieth and sixtieth years, but one case has been observed as early as the twenty-seventh year. They show a striking preference for the skull, but have been observed in the femur, clavicle, sternum, humerus, and on several occasions in the vertebræ.
>
> In some of the patients, the secondary tumors are *large and pulsate*. In the extraordinary case described by Cramer the secondary mass occupied the sternum, and *pulsated so markedly* and caused so much pain that it was mistaken for an aneurism: this induced the surgeon to ligate some of the large vessels.
>
> In England the chief cases have been observed and recorded by Haward, Coats, Horsley, and Lediard. Goebel has collected the German literature in an interesting paper, and has shown that in many instances these tumors have been subjected to operative treatment, and on the whole with satisfactory results.
>
> I think the explanation of this interesting condition may lie in the fact that in the early stages carcinoma of the thyroid is such an insidious disease, and mimics so closely the innocent bronchocele, that the primary disease is overlooked. This view receives some confirmation from the fact that a very similar condition of things is sometimes associated with carcinoma of the prostate.

The following interesting case was referred to me by Dr. B. H. Zwart of Kansas City, first because of slight skin disease of minor importance, second a peculiar pulsating tumor on the left side of the patient's head. Upon examination I pronounced the case a pulsating tumor of the brain probably due to displaced thyroid cells. The following history was obtained from the patient:

> Miss A., age 40, white, native of the United States was examined January 4, 1913. At the age of 20 years she noticed an enlargement of the right and front side of the neck. For several years afterward it was treated with various external applications without result. In 1903 the growth which had become quite large, was diagnosed as goiter, and injections were advised by the attending physician. Two injections were administered a week until 31 treatments were given. (The injections are believed to have been phenol and iodine). The treatment resulted in sclerosis of the gland. The growth did not decrease during or after the treatment.
>
> Because of the implication of the inferior laryngeal nerves the patient had spasmodic attacks of dyspnœa. An operation for the extirpation of the gland was advised. This was done in March, 1905. The growth was successfully removed and proved to be an intrathoracic goiter involving only the right lobe of the thyroid gland.
>
> The patient made a speedy recovery and remained in most excellent health until February, 1910. At this time she felt a tumor-like growth about as large as a hazelnut on the left side of her head. The point indicated was about 2½ inches above and

on a line with the auditory canal. She had suffered no pain, headache, or nausea. There was a stiffness and slight pain at the junction of the angles of the left side of the inferior maxillary with the skull. This stiffness was noticed only when she attempted to eat. May 10, 1910, the tumor had increased to about one inch in diameter. At this time she consulted a surgeon in Chicago who advised removal of the growth.

Operation: An incision was made, the resulting hæmorrhage being so great that the most strenuous efforts were required to save the patient from dying on the table. The growth was *not* removed, the patient made an uneventful recovery and returned home. The tumor continued gradually to enlarge. The patient remained in good health except that she had occasional slight headaches up to about May, 1912, when she experienced a slight tenderness of the scalp and a feeling of soreness in the head. Two days prior, before the pain complained of, she had nausea and vomiting. These symptoms became gradually aggravated until May 14, pain, soreness, and pressure sensation in the left posterior occipital region became very great. May 12, she suffered with nausea for three days and then began vomiting more or less continuously for a day and a half. About May 17, vomiting ceased and she became unconscious and remained so for 36 hours when complete consciousness returned. She had extreme tenderness and pain on the left side and back of the head for two or three days. Before she lost complete consciousness, the right arm and leg were found paralyzed. Two days after consciousness returned the patient had a hæmorrhage from the left nostril and mouth (arterial blood). The hæmorrhage lasted two or three hours; at this time the patient was also menstruating. After the cessation of the hæmorrhage, menstruation ceased. Shortly after the return of consciousness the paralysis that had affected the left arm and leg subsided simultaneously with the pain in the head. The scalp and head in and around the affected area felt very sore for some days.

October, 1912, the left eye had protruded very markedly showing pronounced symptoms of exophthalmos January 10, 1913. Dr. J. H. Thompson made the examination of the eyes and reports as follows: None of the muscles of the eye affected, motion of the eyeball or lids as found in exophthalmos. In right eye pupil responded to light, apparently not affected. Vision absent in left eye. The blindness in left eye was apparent after she returned to consciousness. The exophthalmos in the left orbit was of an extreme degree, the eyeball being pushed straight out. There was no paralysis of any of the ocular muscles. No ptosis. There was some congestion of the upper lid and some conjunctivitis, a condition such as would obtain in tumors of the orbit. The left eye's blindness was due to atrophy of the optic nerve. Although the nerve head was white, it did not show any evidence of previous inflammation. Therefore, the atrophy was considered a pressure atrophy, as the tumor had penetrated into the left orbit. There was no pulse in the retinal arteries but a marked venous pulsation. The retinal veins were not engorged. The eyeball pulsated synchronously with the pulsation of the tumor.

The right eye appears normal, no tumefaction, no exophthalmos, no ophthalmoplegia. Vision 20/40, visual field normal. She complained of transitory attacks of blindness, coming on as frequently as every hour, and then shortly disappearing. The only abnormal condition of the right eye was an acute optic neuritus with retinal hæmorrhages, the so-called choked disc.

For the purpose of determining the condition of the bony structure of the head at the seat of the tumor, Dr. E. H. Skinner made the appended skiagrams and reported as follows:

Two exposures were made of Miss A's skull; one in the postero-anterior, and one in the lateral position.

The findings are as follows: There is a deficiency of bone in the left temporal area extending from a point one-half inch behind and above the external auditory canal to the external rim of the orbit a distance of nearly three inches. The vertical diameter of this space in the temporal bone is about two and one-fourth inches. The upper edge of this space is about one-half inch above a horizontal line touching the external angular process of the frontal bone.

Within the diploe of the parietal and frontal bones there are numerous venous channels which are very much enlarged over the normal size and all of which seem to have their direction toward the upper part of the involved area of the temporal bone.

There is no shadow of the external wall of the orbit. The lesser wing of the sphenoid and orbital plate of the malar bone have apparently vanished. No shadow can be seen of the sphenoidal fissure or the optic foramen upon the left side. All that remains of bone upon the outer external side of the eye is the rim of the orbit.

The antrum of Highmore upon the left side contains no air. The other accessory sinuses of the nose all contain air and cast normal shadows.

To sum up the X-ray findings, we may say that the squamous portion of the temporal bone and a portion of the lateral plate of the frontal bone, anterior thereto, has disappeared through pressure necrosis. That portion of the lesser wing of the sphenoid and the malar bone which form the external walls of the orbit have likewise disappeared and accounts, therefore, for the extreme condition of exophthalmos present in the case. The increased size of the veins within the diploe is a sign of intracranial pressure (Figs. 3 and 4).

The clinical pathological report by Dr. Frank J. Hall follows:

Urine; specific gravity 1,005; light amber color;

reaction sharply acid; no albumin; no sugar; indol, negative; no casts; no red blood-cells; a few leucocytes; no crystals; squamous epithelium; no mucus; nondescript bacteria.

Blood: red blood-cells, 4,000,000; leucocytes, 12,000; hæmoglobin 50 per cent. Blood-pressure: systolic 145, diastolic 140.

Report of and the operation by Dr. E. F. Robinson:

Owing to the rapid and large growth of the tumor, ligation of the common carotid artery was decided upon, as it was evident that tying the external carotid alone would by no means occlude the blood supply from the tumor. Immediate extirpation was evidently impossible. January 16, 1913, at St. Mary's Hospital, under ether anæsthesia, the left common carotid artery was tied without difficulty, in the superior triangle just above the omohyoid muscles. The veins were unusually large on this side of the neck. Just before reaching the sheath of the carotid vessels, the upper left pole of the thyroid gland was found extending unusually high in the neck along the carotid, and had to be displaced outward and downward before the carotid sheath was opened. The vessel was ligated with No. 2 ten day chromic catgut. Immediately, upon applying the ligature, all pulsation in the tumor ceased and it became cyanotic with a marked pallor to the whole left side of the head and face. There was also a noticeable diminution in the size of the growth.

The left eyeball, which had been so markedly exophthalmic that the contour of the posterior portion of the ball was evident, also became much less prominent and the pulsation of the eyeball ceased.

The patient left the operating table, pulse 96, respiration 19, in very good condition. She was placed in bed with head elevated. Six hours after the operation she had not regained consciousness. At this time it was noted that there had developed a complete hemiplegia of the right side. Urine was drawn by catheter; twenty-four hours later her pulse was 84, temperature 100.4°, respiration 20. The condition of coma still existed, but the patient was able to be partially aroused. At this time, however, a slight return of pulsation was noticed along the median border of the tumor for a distance of about one inch. The patient was considered to be in fair condition, when she suddenly died, apparently from embolus, 36 hours after the operation.

No general autopsy was permitted, but we were allowed to remove the tumor. The growth measured 5 inches in diameter and 3 inches anteroposteriorly and protruded 2½ inches laterally from the left temporal region, and a like distance into the cranial cavity.

Before an incision was made several loose, hard particles were felt over the surface of the tumor. These proved to be spicules of bone which were scattered or "infiltrated," over and through the anterior surface of the tumor. The skull was completely disintegrated for a space corresponding to the growth and this had extended into the cranial cavity but had not penetrated the dura mater but pushed it before. It was attached to the dura mater at some points and shelled out with some difficulty. It occupied fully one-third the left brain cavity. It had evidently arisen from the diploe of the left temporal bone, and had grown equally inward and outward, deriving its blood supply not only from the external carotid and cerebral vessel but from enormously enlarged arteries and veins of the diploe of the skull itself. Its gross appearance carried out the conclusion formed that it was a secondary or metastatic thyroid which arose from the cancellous bones of the skull. The macroscopic appearance was that of the thyroid gland. A number of microscopic sections made were structurally identical with normal thyroid tissue. If there was a trace of malignancy it was not discovered.

OTHER CASE REPORTS

F. Cramer[1] reports 3 cases, 2 female, 1 male, of malignant goiter, with pulsating bone metastases.

C. Ewald[2] reports the following cases:

Case 1. Female, age 45. Goiter of the colloid type, without symptoms of malignancy; removed. A year later a tumor had developed on the right scapula; removed; microscopically a thyroid adenocarcinoma.

Case 2. Female, age 26. Goiter, clinically of the colloid type. Tumor of the malar bone that was noted by the patient some years previously — before the goiter began to develop. Microscopically the tumor had the structure of the fœtal or infantile thyroid gland, with slight proliferation indicating a tendency toward malignancy.

K. von Hofmann[3] reports:

Case 1. Female, age 69. Small colloid goiter, first discovered at autopsy. Tumor in the upper part of the upper arm, structure the same as that of the goiter.

Case 2. Female, age 26. Adenocarcinoma of the thyroid gland; metastasis in the malar bone. Both removed. No further report.

Case 3. Female, age 43. Removal of goiter of the colloid type with no signs of malignancy. Soon after the operation, tumor developed on the right scapula, with the structure of a thyroid adenocarcinoma. Recurrence in about two years, tumor removed again. Death two years later, cause not known.

Case 4. Female, age 56. Autopsy showed fibrocellular sarcoma of the thyroid; metastasis in right iliac bone, lungs, etc.

H. Oderfeld and J. Steinhaus:[4]

[1] Beitrag zur Kenntniss der Struma maligna. Arch. f. klin. Chir., 1887, xxxvi, 259.

[2] Zwei Faelle von Kroepfmetastase. Wien. klin. Wchnschr., 1893, vi, 459.

[3] Vier Faelle von Strumametastasen im Knochen. Wien. klin. Wchnschr., 1897, x, 1004.

[4] Zur Casuistik der Knochenmetastasen von normalen Schilddruesengewebe. Zentralbl. f. allg. Path. u. path. Anat., 1901. xii, 209; ibid., 1903, xiv 84.

Female, age 58. Diagnosis of sarcoma of the frontal bone. Tumor removed and microscopically proved to be composed of *normal* thyroid tissue. No goiter; no enlargement of the thyroid. The later article reports recurrence of the frontal growth in a year, with tumors on the right temporal bone, and on the sternum at the sternoclavicular articulation. The right lobe of the thyroid was thickened. Operation and death. In the thyroid a nodule was found surrounded by a connective-tissue capsule, but consisting of normal thyroid tissue except that it was slightly lighter in color. The metastases all consisted of normal thyroid tissue. These authors also note another case, cited by Patel. 1904.

R. Wagner:[1] Female, age 48. Spindle-cell sarcoma of the thyroid gland; metastasis in the left femur.

E. Gierke[2] reports 2 cases:

Case 1. Man, age 57. Paraplegia and girdle pains; fifth dorsal vertebra tender on pressure. At autopsy, tumor found at this site, pressing on spinal cord; microscopically tumor resembled a colloid goiter; thyroid had showed no enlargement, but on careful examination, a nodule the size of a pea was found in the right lobe, resembling a thyroid adenoma.

Case 2. Man, age 46. Compression myelitis; tumor on third dorsal vertebra, and another on first lumbar vertebra; structure that of a colloid goiter; colloid very compact. A small goiter giving no clinical symptoms with no anatomical signs of malignancy.

K. S. de Graag:[3] Female, age 56. Adenocarcinoma of the thyroid, with metastases in the ninth, tenth, and eleventh dorsal vertebræ, of the same histological structure as the malignant thyroid.

M. Patel[4] reviews 18 cases:

Case 1. Patel's own: female, age 65. Hypertrophy of the thyroid gland, with no increase in 30 years, no symptoms of malignancy.

Secondary tumor at inner angle of the orbit, *pulsating*, microscopically of the type of the thyroid. Certain parts reproduced exactly normal thyroid tissue, while other parts had the character of a highly malignant epithelioma. Operation, but return of the growth in a year.

Case 2. Honsell: Female, age 20 years; in February, 1896, operated on for goiter of the colloid type apparently benign. In November, 1898, the part of the thyroid gland left at the first operation had increased very little in size without causing pain or other symptoms. Small tumor on frontal bone, non-pulsating, removed; resembled histologically a colloid goiter without signs of malignancy.

Case 3. Cohnheim (see bibliography): Female, age 35; at autopsy both lobes of the thyroid gland hypertrophied the left lobe showed type of the colloid goiter; the thyroid showed nothing else abnormal except in the median portion a small nodule, which penetrated into the veins. Similar nodules, showing typical thyroid structure were found in the second, third, and fourth lumbar vertebræ and in the right femur.

Case 4. Von Eiselsberg (see bibliography): Man, 37 years old, had a goiter since the age of 21; during four years a tumor had developed between the two parietal bones; microscopic diagnosis showed structure typical of thyroid adenoma. Recurrence in 4 years. No increase in size of goiter.

Case 5. Kraske (quoted from von Eiselsberg): Woman, age 53; tumor of frontal bone, solid and indolent; structure analogous to that of the thyroid gland.

Case 6. Riedel (quoted from von Eiselsberg): Female, age 40. Tumor of inferior maxilla with structure like that of the thyroid gland. Removed; recurrence in ten years. No visible enlargement of the thyroid.

Case 7. Feurer.[5] Female, age 68 years; a small goiter; after a blow a tumor developed on the left parietal bone, penetrating the skull, diagnosed as sarcoma. Tumor partially removed, recurrence and death ten months later. Examination showed that both the thyroid and the bone tumor were composed of typical colloid goiter tissue.

Case 8. Riedel (same reference): Female; large goiter; a tumor developed on the lower jaw, removed; no recurrence in 4 years.

Case 9. Gussenbauer (same reference): Female, large benign goiter. Paraplegia of the legs, and general pain. Tumor located on the right side of the tenth and eleventh thoracic vertebræ; removed; recurrence. Microscopical examination showed typical adenoma of the thyroid gland.

Case 10. Middeldorpf (see bibliography): Female, age 56; a small movable goiter; no symptoms of malignancy. Tumor at the nape of the neck, not pulsating, diagnosed as sarcoma. Removed and found to have structure of a thyroid adenoma. Other bone metastases developed, as shown at autopsy; tumor in the occiput recurred; similar tumors with the same structure found in the lumbar vertebræ, the sacrum, the pelvic bones, and the upper part of the humerus and femur. No change in the goiter found.

Case 11. Jaeger (see bibliography): Female, age 69; goiter for ten years. On examination, tumors found involving the sixth and seventh cervical and the first dorsal vertebræ; a second tumor in the third and fourth lumbar vertebræ; patient stated these had developed after a fall. Second tumor removed, structure that of thyroid adenoma.

Case 12. Goebel (see bibliography): Female, age 54. Goiter of moderate size. Tumor in the femur; removed, femur disarticulated. Microscopically structure of benign goiter.

[1] Zur Kenntniss der Knochenmetastasen bei Schilddruesentumoren. Muenchen. med. Wchnschr., 1902, xlix, 1457.

[2] Ueber Knochentumoren mit Schilddruesenbau. Arch. f. path. Anat., 1902, clxx, 464.

[3] Ueber Strumen mit Knochenmetastasen. Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1903, xi, 625.

[4] Tumeurs bénignes du corps thyroide donnant des métastases. Rev. d. chir., 1904, xxix, 398.

[5] Festschrift fuer Kocher, 1891, p. 275.

CASE 13. Muzio:[1] Female, age 43; goiter for 10 years. After a blow, a tumor developed near the right iliac bone; removed; structure that of colloid goiter.

CASE 14. Von Eiselsberg (see bibliography): Man, age 66, thyroid gland slightly enlarged; after a blow tumor formed on the sternum; tumor removed; death. Autopsy showed colloid goiter; the metastatic tumor composed of vascular tissue with cystic colloid formation; the author states that it was an adenocarcinoma.

CASE 15. Von Eiselsberg: Man, age 33. Benign goiter, on autopsy showing adenomatous nodules in the thyroid; at the base of the skull a tumor found invading the sphenoid; microscopically a thyroid adenocarcinoma.

CASE 16. Author not stated. A colloid growth in the thyroid; malignant thyroid metastases in the vertebræ, the ribs, and the iliac bone.

CASE 17. Litten:[2] Case of adenomatous colloid goiter, metastases in vertebræ, ribs, and iliac bone.

CASE 18. Hollis (see bibliography): Man, age 45. Paraplegia and other spinal symptoms. At autopsy no enlargement of the thyroid gland found, but tumors found in the skull and in the third dorsal vertebræ, causing degeneration of the spinal cord. Tumors consisted of thyroid tissue, but showed epithelial proliferation, suggesting malignancy.

Dercum, 1906 (for exact reference see general bibliography): Female, age 56. A goiter of the simple type — no symptoms of malignancy — removed 6 years previous. Pain with progressive wasting of muscles, paralysis and loss of reflexes in the extremities indicated spinal disease. At autopsy tumors found on several of the ribs on both sides, and on the fourth and fifth cervical vertebræ. Only the larger spinal tumor was examined microscopically, proved to be composed of normal thyroid tissue.

P. Halbron:[3] Female, age 68. With small pulsating goiter, and symptoms of rheumatism; also a pulsating tumor on the sternum, diagnosed as an aneurism of the aorta. At autopsy, the goiter appeared histologically to be of the typical benign colloid type. The bone tumor consisted of thyroid tissue with irregular epithelial proliferation typical of cancer.

E. Emmerich:

CASE 1. Male, age 63. Autopsy showed malignant goiter with metastases in the iliac fossa, sternum and vertebræ. The *bone* tumors consisted mostly of *normal* thyroid tissue.

CASE 2. Female, age 50. Paraplegia. Autopsy showed malignant goiter, metastasis in the first dorsal vertebra, with histological structure the same as the thyroid growth.

Beilby, 1907 (for exact reference see general bibliography): Male, age 65. Clinical diagnosis: sarcoma of antrum; large mass of tissue removed from the upper jaw; microscopic examination showed it to be histologically a thyroid adenoma. Tumor recurred and grew after operation, causing death. No hypertrophy or tumor of the thyroid gland found either before or after the operation.

T. Kocher:[4]

CASE 1. Male, age 60. Had a goiter with symptoms indicating malignancy removed some months previous. Histological examination did not show malignant growth. The bone tumor was on the occipital bone. No operation.

CASE 2. Patient age 58; operated on for goiter, diagnosed as proliferating goiter in July, 1898. In February, 1899, a tumor found on the right clavicle; histological examination not made.

CASE 3. Male, age 77; operated on for goiter on November 13, 1905; diagnosed "proliferating goiter." On November 30, operation for a bone metastasis on the left side of the head, on the frontal and parietal bones. Histological structure not given.

Jaboulay:[5] Female, age 23. Had a small goiter, without clinical symptoms, and *a pulsating tumor*, clinically resembling a sarcoma at the upper end of the right humerus. Microscopical examination showed that the tumor consisted of *typical thyroid* tissue. Resection of diseased part; good results.

Jaboulay:[6] Male, age 60. Patient had a goiter which had not increased in size or caused symptoms for many years, but had grown rapidly for fourteen months before his appearance at the hospital. Tumor on the clavicle, near sternoclavicular joint. Goiter appeared clinically benign, to the marked increase in size and also to the metastasis. Both tumors removed, with apparent success.

P. Barbet:[7] Female, age 65. Pulsating tumor in the upper part of the sternum, diagnosed as an aneurism; followed a fall. At autopsy, the tumor was found to be composed of epithelial cells and some thyroid tissue especially the colloid; the thyroid gland was also infiltrated with epithelial cells.

Migon A. and Bellot:[8] Male, age 68; tumor of the dorsolumbar segment of the spinal column had persisted about 1½ years. Removed, but recurred in about 5 months, ending in death. Examination of the tumor showed it to be composed largely of normal thyroid tissue, but in some portions there were cells suggesting an epithelioma. Examination of the thyroid showed a small indolent epithelioma the size of a hazelnut in the left lobe of the thyroid.

H. Alamartine and P. Bonnet:[9] One case; female,

[1] J. Acad. d. med. d. Turin, 1897.

[2] Berl. klin. Wchnschr., 1889, p. 1094.

[3] Cancer thyroidien développé au nivau du sternum et simulant un anévrisme de l'aorte. Bull. et mém. Soc. anat. de Par., 1904, lxxix, 373.

[4] Zur klinischen Beurteilung der boesartigan Geschwuelste der Schilddruese. Deutsche Ztschr. f. Chir., 1908, p. 197.

[5] Goitre cliniquement bénin avec métastase osseuse ayant simulé un sarcome anévrysmatique de l'extrémité superieure de l'humérus. Lyon méd., 1909, xi, 859.

[6] Goitre métastatique avec tumeur secondaire de la clavicule. Gaz. d. hôp., 1909, lxxxviii, 1243.

[7] Épithéliome du corps thyroïde avec métastases osseuses. Bull. et mém. Soc. anat. d. Par., 1910, lxxxv, 233.

[8] Métastase d'un cancer latent de la glande thyroïde dans de segment dorso-lombaire de la colonne vertebrale. Presse méd., 1910, xviii, 809.

[9] Un cas de goitre benin metastatique. Lyon Chir., 1911, v, 605.

age 23; tumor of upper end of right humerus, appearing clinically like a sarcoma, pulsating. Microscopically thyroid tissue. Patient had a goiter, clinically benign, that was not removed. Operation of resection performed, no local recidivation, but multiple bone metastases caused death.

Regensburger, 1912 (for exact reference see general bibliography). One case, a female aged 55, had a slight enlargement of the thyroid; tumor in the upper arm, which clinically resembled a sarcoma, but on microscopical examination proved to be typical thyroid tissue. Arm exarticulated with apparent success.

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POST-OPERATIVE ILEUS[1]

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OTHERS may have had the dreaded specter of this serious post-operative disease facing them after operating for appendicitis, abscess, or some other pelvic infection, with adhesions, and have groped through the literature for some light as I have done.

The publication of any experience, either practical or experimental, that in any way illuminates this subject is amply justified by a study of statistics of post-operative obstruction. For example, Deaver and Ross (1) report 276 cases with a mortality of 42 per cent. W. B. Coley (2) says that the deaths are from 10 per cent for those operated upon within the first twenty-four hours, to 50 per cent for those operated upon within seventy-two hours. Naunyn (3) studied 288 cases, with 75 per cent recoveries for those operated upon within 48 hours, and only 35 to 40 per cent for those operated upon on the third day. Pilcher (4) reports 40 cases with a mortality of 52½ per cent. Ruge (5) reports a mortality in obstruction following appendiceal abscess of 50 per cent in early obstruction, of 45.8 per cent in late obstruction. Forty-four cases are reported. John Young Brown (6) reports 59 cases operated on early, with a mortality of 20 per cent. He says that delayed operation causes a high mortality. W. C. G. Kirchner (7), in a study of 70 cases, of which 10 were post-operative adhesions for which resection was done, reports a mortality of 50 per cent.

J. B. Murphy (9) says that the causes of adynamic ileus are: (1) muscular paralysis from trauma or exposure; (2) local traumatic peritonitis; (3) local or general septic peritonitis; (4) embolism of mesenteric vessels; (5) phlebitis; (6) strangulation of pedicles by ligatures.

To determine the causes of this high mortality there has been considerable experimental work done and more speculation based upon the clinical picture. I refer to the experimental work of Hartwell and Hoguet (10); of J. W. Draper (11); of Whipple, Stone and Bernheim (12); of McLean and Andrus (13), of Lynch and Draper (14), of Fred J. Murphy, and Barney Brooks (15). Among those who have made autopsy studies are B. F. Davis (17) of Chicago. The experiments of Fred Murphy and Brooks represent to a large extent the results of so many other workers that I shall cite their conclusions.

1. In intestinal obstruction the contents of the obstructed bowel contains a toxin which is absorbed in sufficient amount as to produce definite symptoms of pathological lesions and death.

2. Toxins are the result of bacterial growth. They are not specific from any part of the intestinal tract and may be found in the gall-bladder.

3. The chemical and physical characteristics of the toxic substance may vary with the length of time which the obstruction has existed as well as with the different conditions under which the obstruction occurs.

4. This toxin may enter the circulation by way of the thoracic duct.

5. Death is the result of a toxæmia which may be independent of the infection of the peritoneal cavity or general circulation.

6. The toxic substance does not pass through the normal mucous membrane.

7. In the production of symptoms the factors which make absorption possible are more important than the factors which produce the toxin.

8. Interference with the circulation of the obstructed intestine is the essential factor in allowing abnormal absorption.

9. Simple obstruction of a segment of duodenum or jejunum results in earlier and severer symptoms than similar obstruction of a segment of ileum, because the secretion in the lumen of the former leads to rapid distention and circulatory disturbance of the bowel-wall.

10. Symptoms and pathological lesions

[1] Read before the Chicago Gynecological Society, January 21, 1916. (See discussion, p. 746.)

following the intravenous administration of the contents of a segment of bowel are the same as those described from intravenous injection of certain ptomaine poisons.

11. In the surgical treatment of cases of intestinal obstruction that part of the intestine with a mucous membrane which has been so damaged as to permit of abnormal absorption should be resected rather than drained.

McLean (16) states that as a result of his dog experiments death was due to lowered blood-pressure. Others say that conditions that produce death are similar to hæmorrhage. Everall (18) states that death is due first to secondary peritonitis; second, to splanchnic paresis; third, to absorption of poisonous products.

Braens' (19) experiments show that the absorption from ileus is very slow when the dog can be kept alive for a long time by saline transfusion.

After hearing of these different results one is attempted to ask if absorption is so great, how can there be any dehydration. On the other hand, if the bowel dehydrates so rapidly, how can it absorb sufficient toxins to produce death. However, this is not the *nervus probandi* of our argument.

We have shown this grave surgical disease has a high operative mortality in the hands of the ablest surgeons. An analysis of the methods of treating and operating for the disease will show that the mortality is due to a lack of surgical progress in this field as compared with other departments of surgery. In addition to the timidity and reluctance often manifested in attacking these conditions, owing to our inability to make an accurate diagnosis between general peritonitis and local peritonitis, or as to whether ileus is adynamic or merely mechanical obstruction, postponement of diagnosis, prolonged treatment until ballooning of the intestine (Wahls sign), passing into general tympanites, and finally the vascular changes begin to show which greatly enhance the gravity of the condition.

Undoubtedly as Handley (20) and others have pointed out, our knowledge of the pathology of ileus has been gained in the autopsy room more often than the operating room. Thus the confusion of ideas as to its origin and progress with the post-mortem studies.

We have passed in a brief résumé the causes of ileus. Let us sum up the clinical signs with the three words: vomiting, peritonitis, and obstruction.

The clinical picture of ileus is represented by a patient with the above signs two to three days subsequent to operation for pyosalpinx and adhesions, or pelvic appendicitis, or any pelvic abscess walled off by adhesions. The tenderness is confined to the lower abdomen and to the right, if it be appendiceal. The rigidity is slight and confined to the lower abdomen. There is still respiratory motion in the upper abdomen. The pulse is not as wavering nor the temperature as high as in general peritonitis. In the abdomen that part of the ileum above the true pelvis is distended with gas; still farther up fluids take the place of gas. The pelvic ileum is flattened, congested, and covered with a flaky fluid, over which, as a guard against the encroaching pelvic peritonitis, lies omentum, tangled and adherent. Distention precedes peritonitis. The fires of peritonitis fanned by enemata, cathartics, and other efforts to produce peristalsis, break through the omental and fibrin barriers, and once out of the pelvis rapidly overtake the distention, and the patient is moribund.

It should be borne in mind that while in the above description peritonitis ended in obstruction, the converse is true of obstruction which may end in peritonitis.

The first suggestions for the treatment of ileus that proved at all satisfactory were made by Louis (21) in 1757, and enterostomy was successfully performed by Renault in 1787. Nelaton revived the operation in 1840, and gave it the stamp of orthodoxy, and so on down to the present it remains the sheet anchor with such additions and modifications as circumstances seem to suggest.

To quote from later writers, Fred Murphy advises that the intestine in patients in whom the mucous membrane is destroyed should be resected rather than drained. Tennant (22) advises enterostomy and drainage, and warns

as to the penalty from bowel resection as a greater hazard for the patient. Andrus (23) recommends enterostomy, followed later by anastomosis to close the intestinal wound, and says it is rarely necessary to free from adhesions. Ford (24) recommends enterostomy and drainage. Reynolds (25) advises enterostomy. Graham (26) favors enterostomy, and if the bowel is badly damaged, resection. A. Webb Jones (27) advises drainage of the bowel with irrigation, and later resection and anastomosis. Levings (28) recommends enterostomy and afterward removal of the adhesions. McLean (16) says the treatment should be ileostomy and hypodermoclysis or proctoclysis. Alexius McGlannan (29), of Baltimore, advocates enterostomy to relieve the body of material that is the source of toxæmia and hypodermoclysis. Johnston (30) recommends enterostomy or resection, with irrigation of the upper and lower loop of intestine. Behan (31) says surgical intervention is of doubtful value.

In the *Medical Press and Circular*, London, May, 5, 1915, there appeared an abstract of the Hunterian Lecture on "Ileus Duplex" by Sampson Handley. The report of the entire lecture was published in the *British Journal of Surgery*, for October.

Dr. Kenny and myself working together in the winter and spring of 1914 and 1915 had reached the same conclusions, with the exception that we found ileo-ileal anastomosis to be superior to the ileocæcal, and we believed that if the competency of the ileocæcal valve is of any value in the function of the intestine, any short-circuiting that preserves this function would prove more satisfactory than ileocolostomy.

As we consider that Sampson Handley's work is the most consistent advance that has been made in the treatment of ileus, I will mention the principal points of his method: (1) Ileocæcal anastomosis for ileus due to adhesions or some other cause than peritonitis. (2) Ileocæcal anastomosis and cæcostomy for inflammatory ileus or ileus duplex.

He divides the obstruction into three stages: (a) Obstruction of the ileum alone; (b) obstruction of the ileum with paresis of colon; (c) complete obstruction of colon and ileum.

He reports thirteen cases treated by different methods, and all three cases operated by ileocolostomy with cæcostomy recovered. Only three of the ten cases operated on by other methods recovered. His explanation of the cause of obstruction of the pelvic colon is that peritonitis or pelvic inflammation involves the pelvic colon just as it does the ileus, only more slowly.

My cases of ileus with obstruction of the pelvic colon have all been women in whom salpingectomy has been done in addition to appendectomy, and I attributed the obstruction of the pelvic colon to traction on the ligamentum infundibulocolicum and ligamentum infundibulopelvicum, which are simply folds of peritoneum running back from the uterus and broad ligaments and forming the mesosigmoid. If a section is taken out of these ligaments and the ends pulled upon, after doing left sided pyosalpinx and completing the peritoneal toilet, it is easily possible to kink the sigmoid. Add to this the absorption from the septic pelvis and traction, and inhibition of the blood supply of the mesosigmoid would result. Of course it goes without saying that the bowel peeled off an ovarian abscess is very apt to become paralyzed.

During the fall and winter of 1914 and 1915 we had operated on four cases of obstruction by short-circuiting methods and drainage. Three were cases of obstruction due to adhesions, were short-circuited, and recovered. One was an acute post-operative ileus with fæcal fistulæ. Enterostomy was done, and later ileo-ileal anastomosis. The result, recovery. The fistulæ healed spontaneously.

We decided to run a series of experiments on dogs to ascertain what was the best method of short-circuiting, and as far as we were able to tell how much damage the bowel would stand and recover if put to rest by short-circuiting. A number of methods were tried before we finally settled upon the technique which was as follows:

(1) Make an incision in the abdomen for the short-circuiting above and to the side of the laparotomy incision. (2) Handle in-

testine gently and as little as possible. (3) Keep away from the adhesions. Ileus is caused by the breaking up of adhesions in the presence of pus. (4) Avoid pulling on the mesentery. (5) Make a lateral anastomosis, if possible, between healthy ileum above and ileum just proximal to the ileocæcal valve, as this portion is seldom involved in ileus. (6) Do an appendicostomy or cæcostomy to allow for drainage and for the introduction of fluids into the system.

The first attempt to produce ileus on a female dog was by clamping and bruising the lower ileum. Six days later the mesentery to which this portion, six inches of gut, was attached was ligated and severed from the gut. Ten days later the dog was very sick. Lateral ileocæcal anastomosis was done. Post-mortem six weeks later showed a specimen somewhat damaged due to infection of the abdominal wound; otherwise the result was good.

In the second dog the mesentery was ligated and cut away and the peritoneum stripped off for six inches from the same part of the ileum from which the mesentery was severed. Three days later the stripped bowel was kinked by sewing the muscularis to the muscular coat laterally. Nine days later the dog was very sick and emaciated. Ileocolic anastomosis was done. A post-mortem six weeks later showed perfect anastomosis with some adhesions and the remains of an old peritonitis.

In the fourth dog, a large female, ileus was produced in the following manner: The intestines were stripped of peritoneum for the space of six inches and punctured wounds made by perforating the intestine with needles. Two days later the mesentery was stripped along the side of the intestine and a sponge packing inserted between the mesentery and some coils of the intestine. Three days after this a lateral ileo-ileal anastomosis was done, and the dog made a good recovery. Six weeks later at the post-mortem the anastomosis showed some adhesions. The damaged gut has apparently a normal appearance, and there is no peritonitis.

The next dog to go successfully through the procedure was a large male. The small intestine was ligated in two places about two inches apart and about six inches above the large intestine with silk ligatures. Three days later the dog was vomiting and seemed very weak and emaciated. Ileocolic anastomosis was done. Six weeks afterward post-mortem showed no peritonitis. The anastomosis was perfect. The evidences of back pressure in the cæcum and appendix are well shown. The injured gut was normal in appearance.

Of course, in these cases it was not possible to do a cæcostomy to relieve the above-mentioned back pressure.

The following case so well illustrates inflammatory ileus with the complications, that I report it.

Patient, Mrs. H. G., aged 21, married two years, two years ago had double pyosalpinx. Both tubes and the right ovary were removed. Patient complained of a purulent vaginal discharge, constant pelvic and abdominal pain, and inability to move the bowels without using cathartics and enemata, nausea, and vomiting.

March 18, 1915, laparotomy. Large abscess the size of an orange in the left ovary. The pelvic colon, sigmoid, and pelvic ileum were adherent to the abscess. The bowel was stripped from the mass and released pus poured over the intestines. Left ovariotomy, high amputation of the uterus, and appendectomy completed the operation. The abdomen was closed with a drain in the pelvis. She was returned from the operating room in good condition. On regaining consciousness, she began vomiting, and in spite of eserine, gastric lavage, enemata, and what not, she vomited always clear fluid or fluid mixed with bile. No flatus was passed. On the second morning her pulse was 168, feeble; temperature 99.8°. Her pinched features and hollow eyes showed the effects of dehydration and toxæmia. The stitches were removed, and an enterostomy done, and a tube sewed into the bowel for drainage. Twenty-four hours afterward a fæcal fistula appeared in the pelvic colon, and another in the pelvic ileum.

She rallied slowly. Fluids were given intravenously, subcutaneously, and per rectum, and gradually the convalescence became less stormy.

On April 15, a high incision was made in the abdomen clear of the old wound region; the enterostomy wound closed, and an ileo-ileal anastomosis done, as previously described. In two weeks the fistulæ closed and the patient was discharged cured the last of May.

Two months later, when on a fishing trip in Wisconsin, she had an attack of abdominal pain, vomiting and purging. She said she vomited and passed castor oil, and could not imagine where it came

from as she had taken none since leaving the hospital. Had the oil remained in the short-circuited ileum since it was given her after the first operation, and had the paralyzed gut resumed its function? I believe it had. The radiograms taken lately show that the whole intestine is active.

CONCLUSIONS

1. We believe that the best results are obtained in the treatment of inflammatory ileus by enterostomy and drainage in cases that are so ill that radical measures would be fatal. Enterostomy should be done rapidly and without disturbing the adhesions. When the patient recovers ileo-ileal anastomotic closure of the enterostomy wound and cæcostomy or appendicostomy will complete the cure.

2. In favorable cases ileo-ileal anastomosis with cæcostomy or appendicostomy for drainage and to relieve the back pressure in the colon gives the best results.

3. That by short-circuiting and putting the damaged gut at rest it may be restored to health and function even after vascular changes have taken place.

4. That the mortality of resection for this disease is too high to give it a place in the treatment of inflammatory ileus.

5. That the adhesions should not be broken up or the damaged gut handled in the operation.

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THE OLD ART AND THE NEW SCIENCE OF SURGERY[1]

By JOSEPH RILUS EASTMAN, M.D., F.A.C.S., Indianapolis, Indiana

ART is the application of means and methods to accomplish desired ends. Science is the systematized knowledge of principles and laws. Surgical art is old. Surgical science is new.

The most primitive surgery included all the rudiments of an art. The papyrus of Ebers from the excavations of Memphis records the application of principles and rules in surgical performances. Mummies of Luxor and Karnak of the date of 5000 B. C. and antedating the advent of Adam several centuries show evidence of the practice of surgical art, as they have gold-filled teeth.[2] The art was taught at Thrace and Babylon, at Heliopolis, and hundred-gated Thebes. Its history parallels the history of man.

Empirical asepsis was practiced by the pupils of Susruta, a Sanskrit writer of 1000 B. C. He[3] advised his students to keep their hair and nails short and to wear white linen coats.

At the time of the destruction of Pompeii, surgical handicraft, as evidenced by hundreds of almost incredibly modern-looking instruments and contrivances in the Naples museum, was becoming complex through the grouping of many mechanical ideas, though it cannot be said to have reached the stage of systematic science. If we could remove the rust and verdigris from these ancient appliances in the Bourbon museum and plate them with nickel, we should have before us an exhibition which we would find to be in many respects surprisingly and interestingly modern. Many of these devices should bear, if common impressions of priority are correct, the names of living surgeons. Here are many evidences that surgeons of hazy antiquity appropriated without credit the inventions of the moderns. For example, one may view here the trivalve rectal speculum to which we are accustomed to attach the name of a beloved Nestor of American proctology, as well as modern stone and bullet forceps and trephines with rotary bit-stock handles. The later works of Guillemeau depict an instrument strikingly similar to a modern bone-holding clamp for plating operations.

Throughout nearly all of historic time surgical knowledge was purely empiric. It was art, not science. So it was with the Egyptians, the Babylonians, and the Lusitanians,[4] who exposed their sick in public so that if passers-by had been similarly attacked they might give advice to the sufferers.

It is said that a quasi science of surgery was born in Greece; that neither in Egypt, nor in India, nor in Palestine, nor in Persia but in Greece alone were planted the earliest seeds of scientific culture. "There one must seek the most perfect blooms of human knowledge which in every fortunate land unfolded and bore most precious fruit." (Kurt Sprengel.)

Thus Hypocrates, son of Heraclides, descendant of Aesculapius and Apollo, is said to have raised surgery from a system of superstitious rites practiced wholly by the priests to the dignity of a learned profession. It is probably true that he enriched surgery with principles and truths. In every wound he recommended nothing so imperatively as elevated position of the member as well as a cautious diet. He taught the value of heat in treating wounds and in applying splints to fractures, advised that they be adjusted loosely without compression, thus revealing an early familiarity with the specter of Volkmann's paralysis. This was not surgical science, rather it represented an "undigested collection of experimental notions vaguely described, disfigured by tradition and often rendered inutile by superstition and ignorance."

Scientific surgery according to the modern concept, that is, "formulated knowledge of surgical principles and surgical laws, based on biologic facts," may be said to have come into existence during the last century with the birth of the school of physiologic medicine

[2] Gorton. History of Medicine.

[3] Hellier. The Lancet, Lond., 1910, January 8.

[4] Park. Epitome of Medical History.

[1] Address of President of the Western Surgical Association, Des Moines, Iowa, December 17 and 18, 1915.

founded by Broussais, Bichat, Roser of Stuttgart, and Wunderlich, who called pathology the physiology of the sick, and the advent of cellular pathology, with the associated new development of the ancillary surgical sciences, as physiology and bacteriology; when Virchow, casting away the vagaries of Paracelsus, "arranged in better form than had hitherto been done, a view of the cellular nature of all vital processes, both physiologic and pathologic, animal and vegetable, so as distinctly to set forth what even the people had long been dimly conscious of, namely, the unity of life in all organized beings, in opposition to the one-sided humoral and neuristical (solidistic) tendencies which had been transmitted from the mythical days of antiquity and at the same time to contrast with the equally one-sided interpretations of a grossly mechanical and chemical bias—the more delicate mechanism and chemistry of the cell."

About the same time Pasteur demonstrated that fermentation and putrefaction are caused not by chemical forms as Liebig had taught but simply by the agency of lower organisms.

Thus the pure sciences of cellular pathology and bacteriology of Virchow and Pasteur established and explained causes, principles and laws which joined with the older applied science or art of surgery with its knowledge of phenomena and facts and supported by all the rapidly evolving tributary sciences having to do with the origin, structure, development, and function of living things brought forth the newer group science or compound science of surgery.

We think of Morgagni, Magendie, Bernard, Recklinghausen, Rokitansky, Lister, and Johannus Mueller, and others of their type and generation as among the founders of the modern research science of surgery. Concerning the great surgical architects and artists as well as the philosophers of this important period, it is to be said that however much we may admire their ingenuity in invention or their virtuosoship in technical performances, or their fine skill in spinning theories, we cannot catalogue them among the fathers of present-day surgical science along with Virchow and Pasteur and their sympathetic contemporaries. Thus, Lawson Tait, renowned in the annals of surgical art, cannot, if we recall his polemic to Saenger declaring bacteria to be the products of disease, be grouped with Langenbeck and Billroth, surgical scientists who were "as expert with the microscope as with the knife and equally great with both."

The modern composite science of surgery has evolved chiefly in all the laboratories of its separate component and ancillary sciences where surgical art was and is, alas, too often a stranger.

But let us not assume that surgical art is either subordinate or enslaved to science (Acland). The art is at once in advance of the science and behind it. Here the art is in advance because it observes and makes use of clinical facts of which the science is not yet aware, "believing with strong conviction that which can neither be proved nor ignored." There science is in advance, claiming system and order and an exactness to which the art cannot even pretend.

The relations of the art and the pure science of surgery are intimate and direct. Thus, the art follows in the lead of the science though occasionally it cannot wait for rationalization. They are intimate, though empiric art does not sacrifice life while waiting for the proofs and explanations of science. The relations are direct in the case of all those modern means of research and remedy which the science daily gives to the art in the form of laws and principles of which a score of years ago there was no conception. To the translumination of the body, Roentgen brought the Crookes tube and made shadowgraphs of living organs theretofore inscrutable. To the exploration of dark recesses of the body, optical science brought instruments of precision; and in what were inaccessible places, science holds the torch while art performs its task. The framework of surgical art is made up of accurate data of observation and experiment.[1] About these empiric data of art, science has organized and crystallized principles and laws. Thus, the relation of the art and the science is intimate and direct; they are as the warp and woof of established surgical knowledge.

[1] Acland. Medicine in Modern Times.

The closest relationship exists in the realm of established and accredited fact, for as was said, the art confronted with emergencies cannot wait until science has established her conclusions and science being formulated, proved knowledge and brooking no uncertainties, shrinks from the assumptions of art. However, they unite inseparably upon the high plane of fact.

Now, as formerly, there exists in some minds a doubt as to whether the art of surgery can keep abreast of the science, sustaining itself in the close relationship with the dignity and respectability which it has enjoyed in the past. It has been said that art is a finite thing and science infinite, that the art has already attained or shall soon attain finality but that the science will grow without limit.

Most of us will wish to subscribe to the view of Sir William Stokes[1] who said that "since we are still young upon the earth, the progress of the art of surgery as of the other arts is as certain as that we live and move and have our being."

It was believed that surgical art had reached its last degree of perfection in Napoleon's time and so recent and worthy a surgeon as Erichson[2] declared that in many respects surgical art could advance no farther. He likened the art of surgery to the plastic and graphic arts. Thus, he says sculpture reached its final development 2,000 years ago and no sculptor of modern times can hope to excel the triumphs of the ancient Greek. In painting, he avers, we find, the same early perfection in the work of the Italian, Flemish, and Spanish schools of the 16th and 17th centuries, and as it is with these fine arts so Erichson believed it is with certain branches of human knowledge closely allied to surgery.

He conceived the advance of surgery to have been due to three factors: first, the improvement of technique; second, the increased precision of results; and third, the development of scientific research.

As to the exactitude of performance, and as to precision of results, Erichson believed there was little chance of future progress. For the further development of scientific research he held out more hope. He had a most gloomy outlook upon the future of surgical art, though in the future of surgical science he glimpsed a rainbow of promise. Very old surgeons might welcome the views of Erichson as a pean of satisfaction over what they and their predecessors have done, but young men will proceed unfettered by such views of finality, so often proclaimed by the oracles and so often disproved by time.

Stokes pointed out that the arts of sculpture and painting are purely imitative, whereas the art of surgery is constructive, an essential difference. The "doctrine of finality," he says, "might equally well have been promulgated in the time of Homer and the view held then that poetry had reached its goal, but the production of the great epic, the sun of all ancient literature, did not interfere with the appearance of the imperishable works of Shakespeare and Dante."

Surgical art is "huge in strength and wise in works" and no less illimitable than science, for the two are integral parts of a whole and are inseparable. To look upon surgical art as a thing of finality is to view it in its narrowest sense as a mere handicraft.

Sir Bland-Sutton tells us that surgeons are of two types: craftsmen and biologists. "As craftsmen, there is a limit set to their advance, but in pathology and chemotherapy, the field of progress in illimitable." Here a line of distinction is drawn between surgical handicraft and surgical art-science which includes investigative study and the systematic application of knowledge gained in the research laboratories.

If by study of the progress of surgical art and science we seek an answer to the question of whether the art or the science is becoming increasingly the more important, we must find that more and more it is the "leaven of science which gives habits of mental accuracy and modes of thought which enlarge the mental vision, and, to use an expression of Epicharmus,[3] strengthen the sinews of the understanding."

Morris and Crile designate the present as the fourth era in the development of surgery, or the era of physiology. First, in the division

[1] Brit. M. J., 1886, Nov. 20.

[2] The tendency of modern surgery. Brit. M. J., 1886, Aug. 14.

[3] Osler. Equinematas and other essays.

of Morris, is the heroic era of Hypocrates; second, the anatomic era of Vesalius; third, the era of pathology of Virchow, Lister and Pasteur; and fourth, the era of physiology, appropriately represented by Metchnikoff and Sir Almoth Wright. The present surgical era might with equal fitness be called the era of biology, for it is through the study of the "capabilities and the susceptibilities" and all the attributes of the normal cell complex which makes up the body, the study of the laws of life itself in all relations and of the vital processes that we will attain to that "complete truth which carries with it the antidote against the bane and danger which follow in the train of half knowledge." (Helmholtz.)

Men like Crile and Carrel, who go farthest, advance through the broad science of biology, which touches the problems of life at every point. Surgery must still be heroic; it must still use the synthetic and comparative considerations and the scrutiny of prognostic science of the Hypocratic era. Gross anatomy cannot be abridged. Pathology is still a great basal factor in rational surgical practice but in the fourth and highest era of Metchnikoff, Wright, and Carrel, it is the biologist surgeon, standing upon all the proved knowledge of the art and of the science as well, whose outlook on Nature and all her problems is the broadest because his viewpoint is the highest.

Cushing, a surgeon of the modern era, says that as a training ground for surgery, the anatomic dissecting-room fast gives way to the experimental laboratory.

Garrod, writing of biochemistry and physiology in modern research, says: "We may wander among the streets of a deserted city of the past, may study the fabric of its buildings—the stones, bricks, and mortar employed in their construction—and in this way may gain some knowledge of the uses for which the several buildings were designed. Just so the anatomist investigates the structure of the organs of the dead body. Once more we may tread the streets of a city of today, may watch the movements of the crowds as they pass, the gathering and the dispersal of groups of people. We may study the arrangements for the disposal of waste products, the ways in which food supplies are brought in, dealt with, and distributed. Or we may investigate the police arrangements, the sanitary devices, and the various devices resorted to by the community for its protection. The study of the human organism on such lines is the province of physiology." We are less interested just now in the pathology of the dead than in the normal physiology of the living and abnormal physiology, or what Moynihan calls the pathology, of the living.

Recently the most valuable contributions to surgery have come from the laboratories of biology. We need no priestess upon a tripod to tell us that surgery of the future will look more and more for strength and inspiration to the vigorous sciences of biochemistry and physiology though it must continue to rest upon its original footing of normal and morbid anatomy, nor that the way to the most complete surgical development for any individual will lie not only through the "blood and sawdust" but also through the "glass and brass."

The debt of surgical art to the pure science is great and the reciprocal debt of surgical science to surgical art is hardly less. Surgical science is advancing with unexampled rapidity and no bounds can be set to its possible conquest, yet the progression of imaginative, speculative, investigative science will be more sure and steady with the support of sensible and pragmatic, empiric art upon its flank.

Sir Berkeley Moynihan[1] would have us recognize that every operation the surgeon performs in his daily vocation is an experiment from which something should be learned, that every clinical observation is an addition to the sum total of human knowledge not only of the disorders of the human body but of its orderly working—not only of pathology but of physiology. In devoting attention to the individual problem he is advancing along the road that leads to more light and a clearer, wider outlook.

We do not often see a great surgical craftsman, a gifted exponent of applied surgical art, and a genius in surgical research rolled into

[1] Brit. M. J., 1913, July 26.

one. In Billroth and Senn were combined the qualities of the great executant in surgical technique and those of the laboratory zealot. They are rare examples.

Surgical art and surgical research science rarely reach their highest development in one individual and the practical and desirable alternative has been and will be to associate the genius of surgical research in one individual with the gift of surgical art in another in an harmonious working union. The ideal arrangement of the future will be that which includes the establishment of special laboratories of surgical research in close association with the theaters of surgical art, and which includes the close association of both with large facilities for the study of the broader aspects of disease.

Such an arrangement as this exists in many seats of medical and surgical culture in the older sections of our country and in our western territory where the group idea in medical and surgical practice has been most cultivated, are numerous instances of the close co-operation of pure surgical science with the practical art greatly to the advantage and advancement of both. As an illustration, it may not be invidious to refer to a western institution which, ignoring the hazy arguments of surgical philosophy, has added so much to the more salutary surgical art-science. Here refinement of operative technique vies for supremacy with the detailed study of immediate and ultimate results and thoroughgoing research in morbid anatomy and morbid physiology.

In a comparison of important American centers of clinical surgery, a recent writer refers, with little grace but with much assurance, to western surgeons as still lingering in the earliest or technical stage of development. Respectfully waiving this indictment and basing our judgment on the evidence of our short past and active present, we would admonish those who cling to these older sentiments that with the unquenchable enthusiasm which impelled the early heroes of this bouyant country—"with narrow search and with inspection deep"—our seekers are keeping abreast of the most earnest and eager in the quest of the treasure trove of science.

So many critics have spoken in commendation of surgery of western America that to this one who directs a patronizing allusion to the most distinguished of western clinics, we may, we hope without immodesty, commend the words of Phidias to Pericles,

> You, Pericles, and I, do what we will,
> Are guilty, both of us, of an offense
> That envious natures never can forgive—
> The great crime of success.
> 'Tis at the tallest poppies that men strike;
> 'Tis at fruit-bearing trees that they throw stones.

From many western surgical communities of greater worth than eminence one hears less and less of things and men, and more and more of ideals. Each of these helps with what light it has to dispel the darkness. "It ought to be no disparagement to a star that it is not the sun."

Into the vast and attractive field of surgical scientific research all can enter and work. If we labor and achieve, we shall have the best reward in the approval of conscience; the compensation otherwise is negligible. If we labor and fail, we shall not have labored in vain, for "the tree sucks kindlier nurture from a soil enriched by its own fallen leaves, and man is made in heart and spirit from deciduous hopes and things that seem to perish."

REFLEX ILEUS OF RENAL ORIGIN[1]

By DANIEL N. EISENDRATH, A.B., M.D., F.A.C.S., Chicago

IT has been known for years that some of the surgical affections of the kidney and ureter, especially infections and calculi, may resemble acute appendicitis clinically. Another of the peculiar disguises under which lesions of the upper urinary tract may appear is that of a clinical picture resembling very closely a paralytic ileus. Distention of the intestines, at times of the stomach as well, vomiting, and almost complete obstipation obscure the pain and other symptoms of the underlying renal condition. My attention was first directed to this masking of renal conditions by the article on reflex ileus in Wilms' classical monograph on ileus. He has applied the term renal ileus or *Nierenileus* to the group of symptoms which may appear in cases of ureteral calculi or hæmorrhage into tumors of the kidney or after operations on or injury to the kidney and ureter. As a rule death does not occur from such an ileus, the underlying lesion being a paralysis of the gut of nervous origin due, as Wilms believes, to a reflex irritation of the inhibitory nerve of the intestines, the splanchnic.

The symptoms of this reflex paralytic ileus are (1) meteorism, due partly to the non-absorption of intestinal gases and partly to putrefaction gases which are due to decomposition of increased gland and mucus secretions. (2) Sudden obstipation and vomiting are as important as the abdominal distention. The vomiting does not become fæculent as early as in obturation ileus. Abdominal rigidity and pain may accompany the three chief symptoms just enumerated, the muscular rigidity being due to the close association of the spinal (lower seven intercostal) and sympathetic nerves.

During the past two years I have had the opportunity to study three typical cases of lesions of the upper urinary tract in which the symptoms of ileus overshadowed those of the underlying condition to such an extent that I thought it might be of service to others to direct attention to such a clinical picture.

Case 1. Male, age 63, referred by Dr. Theodore Diller of Aurora, Illinois, with diagnosis of ureteral colic. There was a history of similar attacks for the past thirty years but he had never passed a calculus. When first seen by the writer he had the typical radiations of a right-sided ureteral colic. The abdomen was enormously distended and it was impossible to obtain the passage of either fæces or flatus for over forty-eight hours. He felt nauseated constantly but did not vomit. The patient stated that with each attack of colic during recent years, symptoms of an ileus-like character had appeared. Radiograms (Fig. 1) showed the shadows of four small calculi on the left side in the course of the pelvic ureter but none on the right side, although cystoscopic examination shortly after the attack showed fragments of a stone in the bladder. The paralytic ileus symptoms subsided as soon as the pain ceased, which meant the passage of the stone into the bladder.

Case 2. Male, age 54, seen in consultation with Dr. George McKinlock on account of symptons resembling both an appendicitis and incipient ileus. When first examined the abdominal distention, vomiting, and inability to secure passage of fæces or flatus completely overshadowed the pain in the right iliac region. The only suspicion of a renal origin of the symptoms was after the urine was examined and many red blood-cells found. A radiogram showed a fairly large calculus shadow in the region of the left kidney (Fig. 2) The intestinal symptoms subsided after three days.

Case 3. Male, age 55, referred by Dr. A. J. Patek, of Milwaukee, with the diagnosis of gall-stones made after patient had an attack of severe pain in the right hypochondrium accompanied by marked abdominal distention, vomiting, and complete obstipation. Relief from these symptoms was very gradual, the distention being still a prominent symptom when I first examined him. He had a similar attack shortly after admission to my service but as soon as the ileus-like distention and obstipation had subsided one could feel a mass in the right side of the abdomen which had greatly increased in size in the two weeks preceding his admission to my service. Several ileus-like attacks occurred during the three weeks before his death. Examination of the kidney at autopsy showed that extensive hæmorrhages had taken place into a hypernephroma (Fig. 3) of the right kidney. Each recurrence of bleeding and the resultant sudden increase of intrarenal tension had resulted in an attack of reflex ileus.

I am indebted to Dr. Roy G. Pearce, Assistant Professor of Physiology of the

[1] Read before the Chicago Surgical Society, February 4, 1916. (See discussion p. 749.)

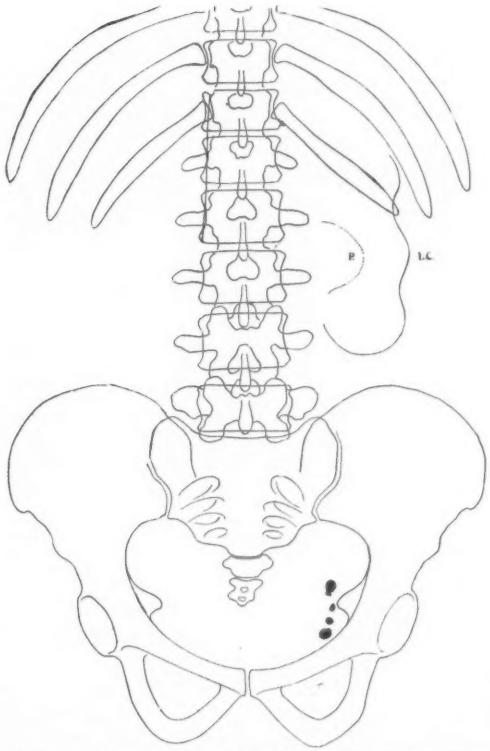

Fig. 1. X-ray tracing of left kidney shadow (hydronephrosis) and calculi in left pelvic ureter. Right ureteral colics and symptoms of paralytic ileus. *P*, Pelvis of left hydronephrotic (*LC*) kidney.

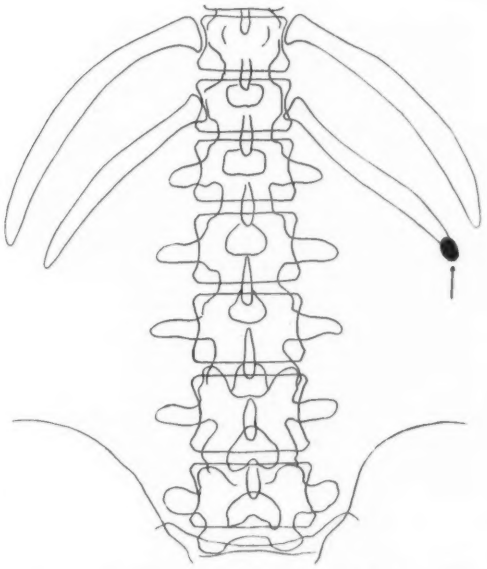

Fig. 2. X-ray tracing of calculus in left lumbar ureter Right-sided pain and symptoms resembling ileus.

University of Illinois, for the following theories as to the cause of this reflex renal ileus.

It is impossible to explain fully the mechanism involved in the production of the ileus which has been described, since we possess an incomplete knowledge of the reflex control of the intestinal movements. The musculature of the intestine like that of the heart is autonomic and contracts without the aid of the central nervous system. The peristaltic movements continue after the removal of the intestines from the body, and are doubtless due to a peripheral nerve control exerted through the plexus of Auerbach. The rate and degree of peristaltic movement is, however, controlled by the central nervous system through the vagi and the splanchnics. The vagi and splanchnics also contain afferent sensory nerve-fibers which are distributed to the viscera, the kidneys and ureters. The diagram (Fig. 4) shows the possible distribution of these nerves to the abdominal organs in man.

Stimulation of the peripheral end of the cut splanchnic nerve in a dog, brings about an inhibition of the intestinal movements, and a decrease in the tone of the intestinal muscle. The ileocolic sphincter is, however, closed by such a manipulation. This is of especial interest since it shows the reciprocal action of inhibition of the movements of the intestines and the closure of the ileocolic valve. Adrenalin, which is secreted upon stimulation of the splanchnic, acts upon the intestines in exactly the same manner as splanchnic stimulation itself.

Reflex excitation of the splanchnic may be brought about by painful stimuli in any portion of the body. Cannon has shown that severe sensory stimulation will reflexly inhibit the intestinal movements and that this inhibition is aided by the increased secretion of adrenalin which accompanies splanchnic excitation. That the splanchnics are reflexly

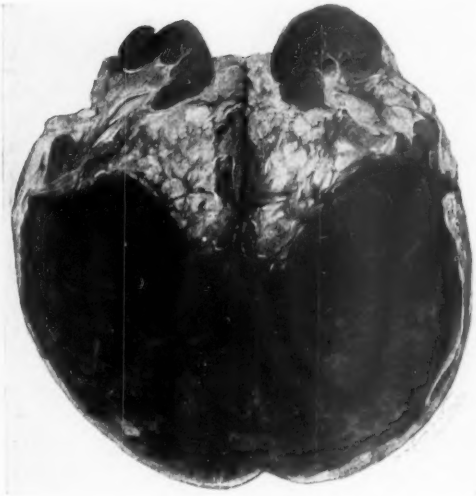

Fig. 3. Hypernephroma of kidney. Middle of mass shows tumor, while lower third shows large blood-clot. With every recurrence of hæmorrhage into tumor the patient had ileus-like symptoms.

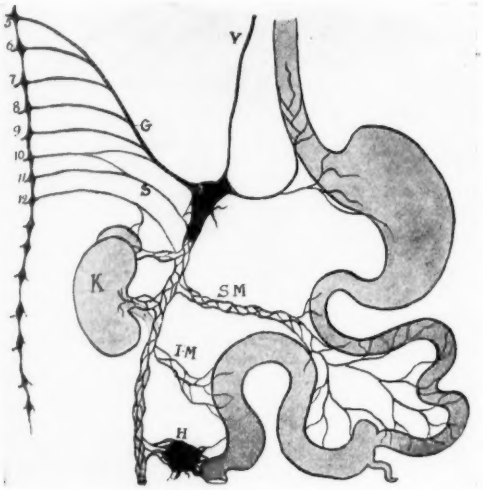

Fig. 4. Diagram of relation of nerves of the kidney to those of the intestine (after Luciani). *K* Kidney, *V* vagus nerve to cœliac ganglion, *G* greater splanchnic nerve, *S* smaller splanchnic nerve, *SM* superior mesenteric plexus, *IM* inferior mesenteric plexus, *H* hypogastric plexus. Note how nerves of kidney and ureter communicate in cœliac ganglion with those of stomach and intestine.

stimulated by nocuous stimuli is shown by the resulting vasoconstriction in the visceral vessels and the increase in the blood-pressure. A plausible explanation for the ileus described can be found in the above facts.

The receptors of the sensory nerves of the kidney, ureter, or peri-renal tissue are stimulated by the passage of a stone, or hæmorrhage into or around the kidney. These severe painful stimuli reach the brain through afferent nerves and reflexly stimulate the splanchnic nerves which bring about a dilatation of the gut, a closure of the ileocolic sphincter, and an increased secretion of adrenalin, which augments the action of the sympathetic. Cannon has shown that such a mechanism is brought into play in case of acute pain, emotions, fear, etc. Such relaxation of the intestines as is present in the reflex ileus described in this paper is probably too long in duration to be wholly explained by simple inhibition due to the mechanism of temporary stimulation of the splanchnics.

In trying to account for what appears to be a complete paralysis of the intestinal muscle following splanchnic inhibition, we are reminded of the interesting phenomena which have been observed in the case of the bivalve mollusk which can hold its shell closed in spite of a great deal of force expended to pull it apart. Parnas found that in the case of *dioxinia exoleta*, it required a weight of 2,400 grams per square centimeter to close the shell against the elastic cushion which forced it open. Yet, the animal can do this for a day at a time with no evidence of fatigue. This would seem to indicate that the muscles do not possess their tone because of a continuous excitatory process, but that the fibers are "hooked up," as it were, by what Bayliss is pleased to call a "catch mechanism" for want of a better translation for the word *sperrung* proposed by Uexkuell. In other words, when the shell is closed, it is bolted shut and held without the expenditure of nerve or muscle energy. If the shell of the mollusk is prevented from entirely closing by placing a piece of wood in the opening, the wood is grasped tightly. If this is removed by twisting or turning, the shell will remain apart and motionless as is the case

with the jaws of a vice when the object which they hold is forcibly removed.

If such a mechanism is responsible for the tone of the intestinal muscle, as it probably is, since the removal of the gut from the body does not cause the muscle to lose its tone completely, we might believe that dilatation and stasis in the intestinal tract, following reflex splanchnic stimulation, is due to a fixation of the muscles in the relaxed state just as in the case of the mollusk, whose shell remains open after removal of the stick, until the abductor muscle is excited and the lock released. We can conceive that the intestinal muscle remains in a greater or less degree of contraction, independent of nerve stimulation after its tone is once established. Extreme splanchnic stimulation by the reflex pain of renal colic, etc., would bring about a temporary inhibition of visceral movements and a dilatation of the gut. If this is continued over a space of time, the intestinal muscles are locked in this position and a strong excitatory influence would be necessary to increase the tone of the now toneless muscle.

This explanation of the reflex paralysis of the intestinal muscles will serve at least as a working hypothesis until some better one is offered. Why it should not occur in every case of severe sensory stimulation of the nerves supplying the urinary tract we are also unable to say at present. We know that a similar paralytic condition occurs after torsion of the spermatic cord, or of the pedicle of an ovarian cyst or after a severe blow upon the abdomen without recognizable visceral injury.

SOME EXPERIMENTS WITH RUBBER GLOVES[1]

By CARL E. BLACK, A.M., M.D., F.A.C.S., Jacksonville, Illinois

We have become so in the habit of the daily use of rubber gloves that for a number of years little has been written on the subject except to emphasize their necessity. The facts which I wish to present have nothing to do with the consideration of the use of gloves as a protection to the patient or surgeon against infection. Most surgeons seem to have come to the conclusion that the use of rubber gloves is a necessity and that the protection which they afford against infection outweighs all other considerations. It is not my intention to combat the idea that this is a very proper conclusion on the part of surgeons and undoubtedly it is almost universally accepted at the present time.

Notwithstanding this consideration, however, there are, no doubt, others than myself who have wished that their hands might be freed from the limitations of movement and touch which rubber gloves impose.

It is well known that a number of surgeons of international reputation for satisfactory technique have never used, or have discarded the use of, rubber gloves. Most surgeons who do not use rubber gloves themselves insist on their use by their assistants. Several conspicuous examples could be mentioned and probably occur to each of us.

What I have to present is entirely from the standpoint of the practical interference which gloves offer to the sense of touch. This interference is not limited to the purely tactile sense but also interferes with our estimate of resistance and power of description. The interferences are partly due to the fact that if the gloves fit properly and closely to the skin in order to protect the sense of touch a certain amount of muscular energy is used to overcome the elasticity of the gloves.

All sensations received by the gloved fingers must be classified as "projection of touch" and theoretically can hardly be expected to possess all the qualities which the mixed sense of touch has in addition to the purely tactile sense, the auxiliary use of the hairs, and the quality of discrimination.

[1] Read before the Western Surgical Association, Des Moines, December 18, 1915.

While we are ready to admit that asepsis is of primary importance in operative surgery I always have a suspicion that we may be missing important information on account of some blunting of the sense of touch by the use of gloves. At least it is only fair that we know just what handicap the gloves give us as well as to study the possibilities of discontinuing their use.

I wish to report a practical experiment in the use of rubber gloves. It seemed to me that the blind who do all their reading with their fingers would give an opportunity for observation on the effect of rubber gloves on the tactile sense which could not be gotten in any other way. With the co-operation of Superintendent H. C. Montgomery, of the Illinois State School for the Blind, and Principal Mrs. L. B. Inglis, of the High School department of that school, six of the best finger readers among the High School students were selected. There were three boys and three girls. The plan of all the observations was the same; namely, to select one hundred (100) words (thirteen lines) of unfamiliar text and new type which had not been used before and to count the number of seconds required to read the 100 words. The figures in the accompanying chart are seconds of time used in reading 100 words. The text was Montgomery's *American History*, and was printed in the Braille which consists entirely of raised dots pressed into heavy paper. The Braille type is based on six (6) dots (1, 2, 3) that is, reading from the top to the bottom, then beginning again at the top, (4, 5, 6). All of the letters are combinations of those six dots (1, 2, 3, 4, 5, 6).

Four series of observations were made.[1] The first series consisted of the observations before any experience in the use of rubber gloves had been acquired.

Observation 1. The bare fingers were used. One hundred words of text was assigned to each pupil. The boys read in an average of 61 seconds and the girls in an average of 49 seconds, or in a general average of 55 seconds for the six pupils.

Observation 2. The hands were covered with thin weight rubber operating gloves. The three boys read one hundred words in an average of 77 seconds and the three girls in an average of 65 seconds or in a general average for the six pupils of 71 seconds.

Observation 3. The hands were covered with medium weight rubber gloves (such as are most commonly used by surgeons). The three boys read one hundred words in an average of 107 seconds and the three girls in an average of 63 seconds, or in a general average of 85 seconds for the six pupils.

In this observation it will be noted that the three girls seem to have read more rapidly with medium weight gloves than with thin ones. This apparent discrepancy is entirely due to the fact that pupil No. 4 had an easy free flowing passage which was easily read. This explanation is emphasized by her results in Observations 2 and 4 where her record is perfectly consistent with that of the others.

There are a number of places where an individual reading would need correction in this way. Instead of being easier than the average it may have been more difficult as for example a passage which contained an unusual number of names of unfamiliar persons or places. The average in seconds must be relied upon to give the correct estimate of speed.

Observation 4. The hands were covered with thick weight rubber gloves such as are commonly used in dressing rooms or by some surgeons in operating. Three boys read one hundred words in an average of 121 seconds and the three girls in an average of 92 seconds, or in a general average of 106 seconds.

It seems reasonably evident from these observations that the sense of touch is blunted just in proportion to the thickness of the covering over the touch organs, of the fingers; that is, the sense of touch, with medium weight rubber gloves covering the fingers, as compared with the bare fingers is in proportion as 55 is to 85, or to put it in another way the medium weight gloves seem to reduce the acuteness of the sense of touch by about 50 per cent.

The second series of observations was made on the same pupils after about two weeks, daily practice in the use of rubber gloves. I left them a supply of gloves with a request that they practice finger reading for a short time each day with the gloves on and I am assured the request was carried out.

Observation 5. The bare fingers were used. The boys read one hundred words in 64 seconds and the

[1] For details and summaries of observation see table which accompanies this paper.

Fig. 1. Three young ladies reading Braille text with fingers.

girls in 38 seconds or in a general average of 51 seconds.

By practice the general average was reduced four seconds notwithstanding the fact that pupil No. 3 took almost twice as long to read as he did in Observation 1, and Observation 20 shows his general average for bare fingers to be only 57 seconds.

Observation 6. The hands were covered with well-fitting gloves of medium weight and each glove was selected to fit the hand which is the only difference between this and Observation 3. The three boys read the one hundred words in an average of 83 seconds and the three girls in an average of 48 seconds, or in a general average of 66 seconds. Comparing this general average with that obtained in Observation 3 it would seem that the two weeks' practice had improved the facility of reading through rubber gloves over 20 per cent.

Considering the great natural facility developed by the blind in using their fingers it would seem probable that this facility would not be further increased to any great extent by prolonged practice.

Observation 7. The hands were covered with very loose, ill-fitting rubber gloves of medium weight and such as are frequently used by nurses and assistants and not infrequently on the hands of surgeons. The three boys read one hundred words in an average of 115 seconds and the three girls in an average of 58 seconds, or in a general average of 86 seconds.

The lesson from this observation is plain. Gloves should be carefully selected to fit the hand so that there will be no slipping or rolling of the rubber tissue on the fingers.

Observation 8. The hands were covered with medium weight, well-fitting gloves containing an excess of talcum powder. The three boys read one hundred words in an average of 110 seconds and the three girls in an average of 46 seconds or in a general average of 78 seconds.

This observation would seem to show that while an excess of powder in the rubber gloves causes considerable diminution in the tactile sense it is not as important a factor as loose or poorly fitting gloves.

In the third series of observations instead of using paper books printed in Braille we used the brass sheets of Braille text from which the paper sheets are printed. These sheets of course are identical with the paper page except that the raised letters are on the brass sheets instead of on the paper. The letters on the brass look much smoother and more definite than on the paper but the teachers and pupils agree that the paper is more easily read.

Observation 9. The bare fingers were used on Braille text on brass plates and one hundred words assigned to each pupil. The three boys read one hundred words in an average of 57 seconds and the

OBSERVATIONS IN FINGER READING WITH BARE FINGERS AND WITH RUBBER GLOVES BY HIGH SCHOOL PUPILS AT THE ILLINOIS STATE SCHOOL FOR THE BLIND, JACKSONVILLE, ILLINOIS

Observation Number	Each observation consisted of the numbers of seconds required for reading with the fingers, 13 lines, or approximately 100 words of Braille text, printed on both paper and brass. The text was new and unfamiliar and a new page was selected for each observation.	1 Carl Kunter	2 Frank Foster	3 Frank Thompson	*Boys' Average*	4 Marie Schaeffer	5 Johanna Crowley	6 Hannah Wessels	*Girls' Average*	AVERAGE
	Prior to any experience in the use of rubber gloves —									
1	Bare fingers	65	68	52	61+	45	52	50	49+	55
2	Thin gloves	72	100	61	77+	67	66	63	65+	71+
	Braille on paper —									
3	Medium gloves	92	130	100	107+	52	65	73	63+	85+
4	Thick gloves	90	180	95	124	76	123	77	92	106+
	After two weeks' daily practice with rubber gloves —									
	Braille on paper —									
5	Bare fingers	45	58	90	64+	35	35	45	38+	51+
6	Well-fitting gloves (medium), dry	55	80	115	83+	46	45	55	48	66
7	Loose-fitting gloves (medium), dry	70	105	170	115	50	55	70	58	86+
8	Excess of powder in well-fitting gloves	75	95	160	110	45	45	50	46	78+
	Braille on brass sheets —									
9	Bare fingers	43	78	50	57	43	45	47	45	56+
10	Well-fitting gloves (medium), dry	55	70	80	68+	37	37	45	39+	54+
11	Well-fitting gloves (medium), hands wet	50	45	65	53+	30	35	32	32+	42+
12	Oil outside of gloves	65	102	100	89	43	44	41	42+	65+
13	Oil inside of gloves	80	90	100	90	47	56	52	51+	70+
14	Oil both inside and outside of gloves	52	74	70	65+	39	39	50	42+	54
	Braille on paper —									
15	Bare fingers	38	50	36	40+	20	38	32	30	35+
16	Oil outside of gloves	101	95	80	92	50	68	72	63+	77+
17	Oil inside of gloves	64	100	65	76+	42	55	52	50+	63+
18	Oil both inside and outside of gloves	65	90	58	71	55	58	57	56+	63+
19	Dry gloves, but paper text oiled	58	80	62	66+	45	45	57	49	57+
	General averages —									
20	Averages for bare fingers	47+	63+	57	56+	35+	42+	43+	40+	48
21	Averages for all medium gloves (dry)	67+	89+	114+	90+	45+	48+	58+	50+	70+
22	Averages for oil inside of gloves	65+	88+	73+	75+	45+	52+	52+	50+	68+
23	Averages for wet hands in gloves	69	105	68	80+	49	53	48	50+	65+
24	Averages for all glove observations	70+	99+	89+	86+	49+	56+	56+	54+	70+

three girls in an average of 45 seconds, or in a general average of 56 seconds.

Observation 10. The hands were covered with well-fitting medium weight dry gloves and one hundred words of Braille on brass plates were given each pupil. The three boys read their one hundred words of text in an average of 68 seconds and the three girls in an average of 39 seconds or in a general average of 54 seconds.

Observation 11. In this observation the gloves were put on wet—that is, filled with water and put on the hands, and one hundred words of Braille on brass plates given to each pupil. The three boys read their one hundred words in an average of 53 seconds and the three girls in an average of 32 seconds, or in a general average of 42 seconds.

In all other observations the gloves were used perfectly dry and no more powder used (except in Observation 8) than was necessary to get the gloves on.

It seems to be demonstrated in Observation 11 that gloves put on wet interfere less with the sense of touch than gloves put on dry. Each pupil remarked on this fact, saying that it was because the tissue did not slip about on the fingers so much.

Observation 12. A perfectly refined mineral oil was put on the outside of the gloves and brass sheets given to read. The boys read one hundred words in an average of 89 seconds and the girls in an average of 42 seconds, or in a general average of 65 seconds.

Observation 13. The same as Observation 12 except that the oil was put on the inside of the gloves. The boys read one hundred words in an average of 90 seconds and the girls in 51 seconds, or in a general average of 70 seconds.

Observation 14. The same as Observations 12 and 13 excepting the oil was both inside and outside the gloves. The boys read one hundred words in 65 seconds and the girls in 42 seconds, or a general average of 54 seconds.

Observation 15 was a control and the bare fingers were used on paper Braille text. The boys read one hundred words in 41 seconds, the girls read it in 30 seconds, or a general average of 35 seconds.

The fourth series of observations was with oil in which the paper text, instead of the brass sheets, was used.

Observation 16. Was the same as Observation 12, except that the paper text was used instead of brass. The boys read one hundred words in 92 seconds and the girls in 63 seconds, or in a general average of 77 seconds.

Observation 17. The same as Observation 13 except that paper text was used instead of brass plates. The boys read one hundred words in 76

seconds and the girls in 50 seconds, or a general average of 63 seconds.

Observation 18. The same as Observation 14 except that the paper text was used instead of brass. The boys read one hundred words of text in 71 seconds and the girls in 56 seconds, or a general average of 63 seconds.

Observation 19. The hands were covered with dry gloves and the paper text was thoroughly oiled with mineral oil. The boys read one hundred words in 66 seconds and the girls in 49 seconds, or a general average of 57 seconds.

Observation 20. Consisted of the averages of all bare hand readings (four observations and twenty-four readings). The boys had an average of 56 seconds and the girls an average of 40 seconds, or a general average of 48 seconds.

Observation 21. The average of six observations and thirty-six readings with the hands covered with medium weight gloves put on dry. The boys had an average of 90 seconds and the girls an average of 50 seconds, or a general average of 70 seconds, as compared with 48 seconds for the bare hands.

That is in an average of sixty individual observations it required an average of 22 seconds longer to read with medium weight gloves than with the bare fingers or to put it another way the time was increased 45 per cent by the use of gloves. This is the central point of the experiment. What effect on technique does such a considerable blunting of the sense of touch have? Are we as surgeons reading our text as well as we should?

Observation 22. The average of four observations and twenty-four readings where oil was used in or on the gloves. The boys had an average of 75 seconds and the girls an average of 50 seconds, or a general average of 68 seconds, or a slightly better average than with dry gloves.

Observation 23. The hands were put into the gloves wet. This average contains in addition to Observation No. 11, two additional observations or three in all, although two of them are not given in detail. There were eighteen readings of one hundred words each and the boys had an average of 80 seconds and the girls an average of 50 seconds or a general average of 65 seconds.

This observation seems to show that medium weight gloves put on wet interfere somewhat less with the sense of touch than any other plan and that thoroughly dry gloves on thoroughly dry hands interfere with the sense of touch more than any other plan.

Observation 24 shows the average of all observations with gloves. The boys averaged 86 seconds (as against 56 seconds with bare hands, 90 seconds with dry gloves, 75 seconds with oiled gloves, and 80 seconds with wet gloves). The girls averaged 54 seconds (as against 40 seconds with bare fingers, 50 with dry gloves, 50 with oiled gloves, and 50 with wet gloves). The general average was 70 seconds (as against 48 seconds for bare fingers, 70 seconds for dry gloves, 68 seconds for oiled gloves and 65 seconds for wet gloves).

CONCLUSIONS

1. The use of medium weight rubber gloves requires the blind to use an average of 22 seconds more in reading one hundred words of Braille than with the bare fingers; namely, 48 seconds with the bare fingers, and 70 seconds with medium weight gloves. Or in other words, there is a loss of nearly 50 per cent in the sense of touch judging from the results of this experiment.

2. The tactile sense is materially improved by putting on wet instead of dry gloves, the difference being an average of five seconds or a little less than 10 per cent. Gloves put on with oil on the hands give a slight improvement over dry gloves; namely, 68 seconds as against 70 seconds.

3. The tactile sense diminishes in direct proportion to the thickness of the gloves as shown in our first series of observations where thin gloves showed an average of 71 seconds, thick gloves showed an average of 106 seconds as against an average of 48 seconds with the bare fingers.

4. A marked improvement in the tactile sense is brought about by the use of carefully fitted gloves as shown in our second series where by care in fitting, the average was reduced from 70 seconds to 66 seconds.

5. As a final conclusion we may say that the final result of the experiment is that gloves put on wet give the most favorable opportunity for exercising the sense of touch and gloves put on dry give the least favorable.

INJURIES OF THE SPINAL CORD

With Report of Gunshot Injury of the Cord at the Fourth Cervical Vertebra and Successful Removal of Projectile

By AUGUST SCHACHNER, M.D., F.A.C.S., Louisville, Kentucky

THE following case was referred to me by the family physician, Dr. Frank J. Kiefer, of Louisville.

Joseph H., age 13 years, was accidentally shot by his cousin on October 5, 1912. The projectile was a 22 long, fired from a rifle, at a distance of about six feet. At the time of the accident, the cousin was standing and the victim seated at luncheon. The ball entered just below the malar process on the left side, ranging downward, backward, and inward.

It became arrested by embedding itself in the cervical portion of the cord, at a point corresponding with the junction of the column of Goll and Burdach. In its position the long axis of the projectile corresponded with the long axis of the cord. On being shot, he uttered a cry, fell from his chair and rolled up, as he expressed it, in a "ball."

He was unable to speak and lost consciousness. Directly after the accident, he was removed to the Jewish Hospital, a distance of about three or four miles from the scene of the accident. On reaching the hospital, his condition was one of evident shock. His skin was pale, cool, and clammy. His pulse weak and collapsible.

Between the time of the accident and his being placed in the hospital bed, covering a space of almost two hours, and a distance of three or four miles, he lost and regained consciousness three times; the first time, on receiving the wound, the second, on being exposed to a sudden jar while carried through the hospital, and the third time, as the result of handling, which his undressing necessitated. The mucous membrane of his mouth was swollen, but unbroken, and particles of food were still present. Pressure at a point in front and below the angle of the jaw on the wounded side seemed painful. He afterwards spoke of both arms and legs as feeling dead, or being unconscious of possessing arms and legs. Hyperidrosis was noticeable during the first forty-eight to seventy-two hours. This gradually ceased.

Loss of expulsive action of the bladder and bowels existed for four days, with gradual return of function, beginning on the fifth, and practically complete return by the eighth day. The loss of consciousness was transient and hardly complete. The reaction from shock began almost directly after being placed in bed and commotion ceased. The return of motion was more rapid on the right side and in the arm. Return of function in the right arm began about the eighth day and was complete in three weeks. Beginning return of function in the left arm, delayed until four and a half weeks. The right leg began to improve soon after the right arm, but improvement was not so rapid in right leg as in the right arm.

During this period he was considerably annoyed by involuntary jerking in the right leg. Improvement began in the left leg eight and a half weeks after the accident. A sense of deadness and heaviness throughout the body prevailed for about two weeks and was noticeable months thereafter during exercise. The first evidences of vasomotor changes were noticeable on the second day, the left hand had a glossy, full, and red appearance, with some tenderness to touch.

The left arm and leg exhibited circulatory changes, most noticeable in winter and on allowing the arm to hang. The left arm would get cold before the left leg. The heaviness of the left leg, which somewhat remains, disappears partially with exercise; the left leg "goes to sleep"; the left arm is more tired than the right and involuntarily spasmodically extends itself. Two and a half months after the accident, spastic changes were well developed in the left arm and leg. Sticking or scratching with a pin, or stroking with a finger or finger-nail, the ulnar side of the right arm, from its lower third downward to the little finger, especially the region represented by the distribution of the ulnar nerve and more on the palmar aspect of the hand, develops a shoulder clonus on the left side. The gunshot wound healed primarily without any unusual local or general reaction.

On the fourth day after the accident, two radiographs were made, a lateral and an anterior view. The existence of the projectile was distinctly evident, and its *precise* location was interpreted by the radiographer as being in the region of the lamina of the third cervical vertebra.

First operation. On the following day (fifth) in the presence of the radiographer, an incision was made to the left of the cervical spine, and the second, third, and fourth cervical lamina exposed without finding the projectile. The incision was enlarged upward and downward, as far as the sixth lamina inclusive, without avail. The radiographer, who acted as pilot, suggested a corresponding point anteriorly instead of the lamina, as the probable location.

Second operation. The exploratory wound having healed, on the advice of the radiographer and surgical consultant, two weeks thereafter a second exploration was undertaken.

An incision was made along the anterior border of the sternomastoid muscle on the left side, the

carotid sheath pulled aside, and the pedicle and transverse process of the third cervical vertebra exposed to view. By continuing the exploration between the carotid sheath and the plexus of cervical nerves, the opening permitted a palpation of the region of the third and fourth cervical vertebra laterally and anteriorly, with negative results.

This, like the first wound, healed primarily. Following this operation, there was an improvement in the entire condition, due to the gradual subsidence through time of the effects of the undestructive element of the injury. This improvement continued until the latter half of December, two and a half months after the injury.

Continued observation, from time to time, between December 1912 and April 1914, confirmed the opinion of a progressively destructive lesion and the necessity of further surgical efforts.

Third operation. Another set of radiographs was prepared and with the aid of a stereopticon, it was definitely settled that the projectile was within the spinal canal and at a point corresponding to the fourth cervical vertebra. On April 14, 1914, an incision was made over the spine of the second to sixth inclusive cervical vertebra, and the lamina of the third and fourth cervical vertebra removed. Nothing abnormal was noticeable on opening the spinal canal, either by inspection, palpation, or the use of the probe. The membranes were opened and a profuse flow of cerebrospinal fluid followed. This was practically controlled by packing off the canal with gauze.

The location of the projectile was now apparent beneath the surface and to the left of the posterior median fissure. The overlying cord structure was incised longitudinally with a cataract knife down to the projectile, and the latter carefully extracted. As the openings in the membrane were almost closed, packing, that had been placed to control some venous bleeding from the side of the bony opening, became dislodged and at once the wound filled with blood that continued to well over its edges. Efforts to control this through forceps and packing were only partly successful.

The condition of the patient, which had been entirely satisfactory, now became so critical, that the entire wound was rapidly packed with gauze and a few silkworm sutures inserted to keep this in place.

He was removed to his bed in profound shock, from which he reacted after the lapse of five or six hours. The packing was allowed to remain until the end of the fifth day. During these five days, the discharge of cerebrospinal fluid was sufficiently free to necessitate the change of the external dressing from once to twice a day.

At the end of the fifth day he was removed to the operating room and the wound edges from the skin surface to the bottom infiltrated with a half per cent solution of novocaine. Under this local anæsthetic the packing was removed and the remaining opening in the membrane sutured and the wound closed. All of this and the primary healing of the wound was accomplished without any untoward effect. He left the hospital at the end of three weeks wearing a collar from the chin to the sternum, consisting of several layers of gauze, and three thicknesses of adhesive plaster. This was discarded two weeks later. The after-treatment consisted in massage, electricity, and the correction of the left hand.

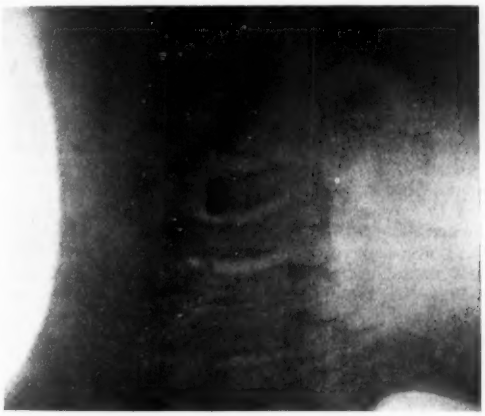

Fig. 1. X-ray showing location of bullet. (See case report for description.)

The drop-wrist, the extended first phalanges, and the flexion of the second and third phalanges, were brought into a straight line and held thus through a splint and plaster dressing for about eight weeks, with a distinct improvement in the condition.

Present condition, fifteen months after the third operation or the removal of the projectile from the cord. The bladder and bowels are normal. Sensation is diminished on the right as compared with the left side in the legs, except in the femoral regions, where they seem alike. The same applies to the thermic test. Left-side arm and leg suffer more from cold when exposed than right. Cyanosis and coldness of left hand absent since removal of projectile, as well as the sensation of pins and needles or crawling like ants. Left shoulder clonus developed by sticking lower ulnar region on right side with a pin, but less so than formerly. Spastic paralysis of the left hand consisted of extension of the first phalanges and the flexion of the second and third giving the hand a clawing appearance.

MEASUREMENTS OF LEGS

	Inches
Right leg at calf	12
Right thigh	18.25
Left leg at calf	11.5
Left thigh	17

MEASUREMENTS OF ARMS

Right arm at middle..... 9
Left arm at middle..... 6

Measured about 2 inches below the elbow, there was a difference of 3 inches in favor of the right. This increased difference in the measurement of the upper extremity, over the lower, may be explained somewhat on the ground of the difference in use. He was better able to use his left leg than he was able to use his left hand. The use of the left arm showed little restriction over the right, but the same was not true of the left hand and therefore there was not as much use made of the left side as of the right.

The spastic condition of the left hand, as already described, interfered with his picking up and handling small objects; large ones could easily be cared for. The thumb was the most useful of the fingers on the left hand, and the usefulness diminished as we passed from the thumb to the little finger. This diminution was especially noticeable in the ring and little finger.

The left arm at rest hangs by the side suggesting limpness, and the left foot shows a slight eversion, little unsteadiness, and tendency to drag. The general picture suggests that of hemiplegia in a mild degree. He was unable to raise the left arm as high as the right, but the ability to raise the arm is very much improved since the last operation. Plantar reflexes increased on the left over the right side; knee reflex increased on the left and diminished on the right. He says the right side still has an indescribable abnormal sensation.

FREQUENCY

Frequency of gunshot injuries of cervical vertebra are, according to Hoffmann, as follows:

In the Civil War they amounted to 0.25 per cent of all gunshot injuries; in the Franco-Prussian War, 0.36 per cent; in the Greco-Turkish war, 0.39 per cent; in the Spanish-American War, 0.55 per cent. So far as gunshot injuries of the cervical region, as compared with gunshot injuries of other spinal regions. Quene gives the following figures: Among the French during the Crimean War, the cervical vertebra 49 or 31.4 per cent; thoracic region, 74 or 48 per cent; lumbar region, 31 or 19.9 per cent. In the Franco-Prussian War, according to Graf and Hildebrandt, in 367 gunshot injuries of the vertebra, 93 were in the cervical region, 134 in the thoracic region, 62 in the lumbar region, 78 in the coccyx. In the Civil War, according to Otis, there were 382 gunshot injuries of the vertebræ; 91 in the cervical region or 23.5 per cent, 136 in the thoracic region or 35.8 per cent, 149 in the lumbar region or 39 per cent.

LOCATION, NATURE, AND EXTENT OF SPINAL INJURIES

Through a careful examination of the segmental disturbances, motor and sensory, coupled with the roentgen rays, the location of the projectile, and to some degree the osseous injuries in the majority of cases, can with reasonable certainty be determined.

When it comes to estimating the nature and extent of injury to the cord, it is a different matter altogether. Here a study of some of the accessible cases in the literature, notably those of Allen, Winslow, Murphy, Muller, Butt, and others, readily convinces one that the clinical data may be so misleading as not to be able to determine with reasonable certainty as to whether we have a destructive lesion with anatomic cord changes, or as to whether we have a case simulating a destructive lesion but clearing up with time; and vice versa, cases that in the beginning did not seem serious, but grew serious with time, days or weeks, and in some progressively growing worse until extensive paralysis, or death ended the scene—Henle, Barker, Murphy, and others.

While a carefully prepared set of radiograms, stereoptically studied will supply valuable data as to the course of the projectile, and the probable nature of the spinal injury and from which valuable conclusions as to the possible existence and probable extent of cord injuries can be drawn, it is pardonable to emphasize the warning that the diagnosis, however carefully made, is frequently misleading. It is an easy matter to find in the literature reports from reliable sources, of quite a number of cases, which through time, operation, or autopsy, were shown to be in point of cord injury, just the opposite to that which in the beginning they were thought to be.

CONCUSSION

The term "concussion of the cord" is one about which there is a considerable difference of opinion, accepted by some and rejected by others. The term may be said to mean the impairment or loss of function without

the existence of gross anatomic cord changes. Muller says:

> Stacks of literature have been written about it and many an expert witness has been paid a fee for testifying to its existence. But "to the impartial observer the conviction must be inevitable that the weight of evidence is against the existence of the condition" (Bailey). Many of the statements in favor of the state of concussion have been derived from the finding by the surgeon at operation of an apparently normal cord, but we now know that tremendous damage may be done to the cord, the white and gray matter being shaken up together and indistinguishable or one driven like a wedge into the other, and yet no visible external change is discernible. The comparison with the numbed and tingling nerve or the concussion is not a true one, as the surroundings of the cord are entirely different and the symptoms of its injuries never transitory.

Those rejecting the term do so mainly on anatomic grounds, the size of the cord as compared with the spinal canal, its curvatures, the presence of cerebrospinal fluid, and its ingenious suspension through the dentate ligament and nerve-roots.

M. S. Barker in his paper "Traumatic Hæmatomyelia" affords satisfactory explanation of many of these cases. His classification includes four varieties: local, profuse local, disseminated, and profuse disseminated.

> For many decades it was one of that group of unknown conditions (except symptomatically) known as railway spine. How many conditions were contained in this group is not known, but it is certain that one of the most important of the group was removed from it when hæmatomyelia was identified and placed in a category by itself. We now find ourselves facing a new danger that nearly all cases, that were once known as railway spine, are now placed, or in danger of being placed in the category of hæmatomyelia (Barker).

COMPRESSION OF CORD

Compression of the cord may be due, primarily, to the presence of a projectile or other substance, or a portion of a vertebra impinging upon the cord. Secondarily, the compression may be due to œdema or hæmorrhage. The effects of pressure on the cord in rare cases may be greatest on the side opposite the lesion (Hunt and Woolsey). According to Bruns, the segmental root pains, indicating the level of the lesion, are due to compression of the segment from which the root springs and not to pressure upon the root in its intraspinal course.

The hæmorrhage may be extradural, intradural hæmatorrhachis, or both extra- and intradural, or into the cord substance, hæmatomyelia. When the hæmorrhage is into the cord substance, it may give rise to a cyst, which is responsible for a traumatic syringomyelia.

When we suspect a hæmatorrhachis, a lumbar puncture will confirm the existence of the same, as well as relieve if practiced early, the pressure within the space. Twenty to forty cubic centimeters of fluid should be drawn off.

Hæmatomyelia, as a pathologic entity, is of comparatively recent origin and, according to Thorburn and others, is underestimated in its frequency. Six out of his twenty-one cases of injury to the cervical spine showed hæmorrhage into the cord and unaccompanied by any apparent injury to the column itself.

Thorburn's and Parkin's cases of hæmatomyelia all occurred in the cervical region and at about the same area. This was partly attributed to acute flexion. That other causes than flexion are responsible is proved by the number of cases in which hæmatomyelia occurred without acute flexion. It has been pointed out that the hæmorrhage selects the grey matter of the cord over the white because the vessels are less firmly supported in the grey matter. As the grey matter is most predominant in the cervical region, it is the most favorable region for its occurrence.

Cushing believes that the possible existence of a special vessel, or vessels, such as Charcot's artery in the brain, is the best explanation of its occurrence in one special area of the cervical region. Since its occurrence in other regions, unless attended with some gross spinal lesion, is of comparative rarity, the lower cervical region, primarily the eighth cervical, up to the triceps level, is considered the favorable region for hæmatomyelia. (Cushing, Berkley, Hoch, Lloyd, Schmaus, and others). Barker has pointed out that when hæmorrhage does occur in the white matter, its progress is hindered by the barrier which the axones offer.

DESTRUCTIVE LESIONS OF CORD

These lesions may be due to the initial injury or to hæmorrhages and changes that follow secondarily. They may be limited or extensive in their scope. They may be early or late in their manifestation, and they may be stationary or progressive in character. The progressive character may be dependent upon a continued irritation due to the presence of a foreign substance as the projectile, or an irritation, œdema, or a degeneration due to a traumatic myelitis, or secondary changes following a hæmatomyelia. The degree may vary from that of a contusion to a complete transverse lesion involving the destruction of a limited or extensive area of the cord.

The practical side of destructive lesions depends upon the extent of the destruction. Upon this rests the question involved in the surgical treatment; namely, as to whether or not operative interference is indicated.

With what certainty can we determine the existence of a complete transverse lesion?

According to Thomas, the factors in drawning the conclusion that there is a complete transverse lesion of the cord are:

1. Complete paralysis usually of the flaccid type.
2. A complete loss of sensation in all its forms.
3. Absent reflexes, especially the knee-jerk, while the planter reflex, on the contrary, is often retained.
4. Complete paralysis of the bladder and rectum with priapism.
5. Vasomotor paralysis with severe sweating in the paralyzed parts.
6. And most important, absence of variations in the symptoms.
7. Absence of irritative phenomena such as pain.

Walton, who has studied fractures of the spine, states there are no symptoms which establish (otherwise than through their persistence) irremediable crush of the cord. While total relaxed paralysis anæsthesia of abrupt demarcation, total loss of reflexes, retention, priapism, and tympanites, if persistent, point to complete and incurable transverse lesion, the onset of such symptoms does not preclude a certain degree, at least, of restoration of function. He also states that we have no infallible guide to the extent of the lesions. *Loc. cit.* Burrell.

TREATMENT OF SPINAL INJURIES

A careful consideration of the spinal injuries, as they are revealed in literature, justifies one in emphasizing the importance of not *too readily* dismissing injuries of the back as sprains; and sprains of the back that persist should be carefully examined, and, if necessary, X-rayed.

No effort should be made to elicit crepitus in injuries of the cervical region. This should be replaced by the roentgen ray. In the first-aid handling of the subject suspected of spinal injury, it is desirable to exercise care and to keep and transport them as much as possible in the position in which they were found, until more definite information, as to the nature of the injury, is obtained. It seems needless to say that an air or water bed and the catheterrization under the strictest precautions should be carried out. Shock, which is rarely absent, is the first indication.

The roentgen ray, spinal puncture, and a careful neurological study is the diagnostic triad upon which we are dependent. The radiogram should be studied stereoptically. The spinal puncture will not only afford data as to the existence of a hæmatorrhachis, but, through the withdrawal of fluid, will relieve the pressure. It will not permit of a differentiation between a hæmatorrhachis and a hæmatomyelia. The symptom-complex of both is similar. In meningeal hæmorrhage the chief stress is laid upon the irritative phenomenon, acute and immediate spinal pain increased by spinal movement. Radiating pains from the supposed pressure of the blood on the spinal root and referred over their distribution is characteristic, and on it Kocher lays especial stress (Cushing).

In intramedullary hæmorrhage the paralysis is frequently of the Brown-Sequard type, due to unilateral compression, and may increase in keeping with the hæmatomyelia. The duration of symptoms in hæmatomyelia is longer in hæmatorrhachis and, owing to the tendency to a syringomyelia, may leave permanent traces.

The examination of the spinal fluid will set at rest the question of infection, should this be suspected. In this connection, the suggestion of Woolsey, that the investigations of Crowe be utilized, is worthy of trial. Crowe developed the fact that urotropine is eliminated through the cerebrospinal fluid and the maximum of elimination is reached in from one-half to an hour after its administration. Woolsey therefore suggests the giving of fif-

teen grains before the operation and its continuance for several days, giving thirty grains or more every twenty-four hours, thus inhibiting the growth of organisms and the dangers of meningitis.

It is difficult to avoid the conclusion that an accurate estimate of the cord destruction is frequently impossible. If this fairly represents the status, is it not proper to lay down the axiom, "When in doubt, explore"?

Such a course is only in keeping with the trend of present surgery in serious conditions in other regions, whenever doubt exists. The fact that laminectomy is not as simple as most other explorations, should, in competent hands, not be a sufficient bar.

The development of surgical technique should naturally carry with it a growing increase in its application. The rules in vogue one or two decades ago should hardly hold, or at least with the same force today as they did then. Furthermore, such a position is supported by operative results as follows:

C. E. Black reported a collection of 552 cases taken from the literature. Of the cases operated on, 49.2 per cent recovered and 40 per cent died; of those not operated on, 25 per cent recovered and 65 per cent died. The fracture cases gave the following figures: the mortality of operation in the cervical region was 71 per cent, without operation, 85 per cent; in the dorsal region, 48 per cent, without operation, 64 per cent; in the lumbar region, 26 per cent, without, 50 per cent. Many of these cases are old and before the technique of aseptic surgery reached its present perfection.

Even as long ago as 1898, Prewitt tabulated 49 cases of gunshot wounds of the spine treated since the aseptic era. Of this number, 24 were operated on, with 13 deaths, and 25 were not operated on, with 17 deaths. Haynes collected the cases of gunshot injury from the date of Prewitt's paper, up to 1906, and found a mortality of 42.5 per cent in the operated cases, and 69.25 per cent in those not operated on (Muller).

Nowhere is timeliness more important than in spinal surgery. After the subsidence of shock and the adjustment of the nervous system to a condition where some conclusion can with more safety be drawn, the earlier the operation is performed, the better.

Degeneration is by many supposed to begin about the fourth day. Cases where a careful study justifies the opinion of a complete transverse lesion or where it is believed to be a contusion or hæmatomyelia, operation is contra-indicated. In the first instance it is generally considered hopeless, except in the caudal zone, and in the other instance it is useless. Where, however, the evidence is not absolutely convincing, especially after a cautious delay and reasonable doubt still exists, exploration should prevail.

If modern surgery can lay claim to any achievement, it is the elimination of doubt, through cautious exploration, and the fact that some exploration can be shown to be useless or even a few fatal, does not, in the writer's judgment, invalidate the broad application of the rule.

Even late operations are not without their advantages, as the writer's case proves. It is difficult to disprove that advantages did not attend, through decompression, many of the explorations in which the surgeon did not make any definite move after the cord was exposed.

The ultraconservative views on spinal operations have been presented by Allen (3).

The question of a transverse lesion, with complete destruction of the cord and the possibility of its regeneration through myelorrhaphy, is an open one. The claim that evidences of at least some regeneration exist is made by those who have practiced the procedure; namely, Briggs 1898, Hart and Stewart 1902, Fowler 1905, Shirres 1905, and Estes of Bethlehem, Pa.

On the other side, the possibility of regenertion is doubted or denied, except in the caudal zone, by Muller, Murphy, Thompson, Krause, Crumston, and others.

Ramon y Cajal and Marinesto have demonstrated that repair does not occur in myelorrhaphy. These observers only encountered neurofibrillæ, having a very irregular course and composed of amyelinic fibers and hardly any of them passed through the cicatrix; therefore histologically there is no medullary regeneration, so that the case recorded by Stewart and Hart remains still unexplained (Crumston).

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THYMUS DEATH

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ONE of the most fascinating and at the same time imperfectly understood conditions is the so-called thymus death.

An immense amount of work has been done on this subject and the problems presented have been studied from various viewpoints without clarifying the situation to any great extent. Arbitrary statements usually based on entirely insufficient data are made by various observers. Thus a pathologist may have autopsied a considerable number of cases which neither he himself nor anyone else had observed accurately during life. Or a surgeon may have operated on one or two cases with or without satisfactory result and has failed to give a complete record of the case. Again many cases are studied from the standpoint of the minute anatomy without regard to the gross pathology or the clinical manifestations. It is this incompleteness of the work of the various observers that serves to make this problem appear hazy and obscure.

In order to better understand the pathology a brief review of the anatomy and physiology of the structures involved in the morbid process is here given.

The thymus gland develops as a paired organ from the ventral part of the third branchial cleft. These unite early in the embryological development, and at birth the thymus lies in the superior and anterior mediastinum extending downward as far as the fourth costal cartilage and lying on the surface of the pericardium and superficial to the innominate veins. It reaches above somewhat higher than the jugular notch and pro-

[1]Read before the Chicago Gynecological Society January, 21, 1916, and Chicago Pediatrics Society, March 22, 1916. (See p. 746 for discussion.)

longations of each lobe upward may reach the thyroid (L. S. Dugeon, 1). Probably no other organ of the body shows so much variation as to shape and size. There is no constant morphology of this gland. W. M. L. Coplin (2) divides the various thymi into groups—unilobular, bilobular, trilobular, and conglomerate thymus. Each of these groups is divided again into three types, cervical, thoracic, or cervicothoracic according to the position of the gland. N. B. Harmon (3) found some cases in which the thymus tissue extended along the carotids to their bifurcations, and often intimately associated with the vagi nerves. Accessory lobes occur that may be independent of or united with the thymus or thyroid glands. Jacobi (4) points out that the thickness of the gland is very important and says that the distance between the vetrebræ and the posterior surface of the manubrium sterni is 2 cm. He calls this the critical distance, and thymi that encroach upon this abnormally cause pressure symptoms and pathological changes. The thymus is movable and ascends on expiration (L. Rehn, 5).

According to A. Hammar (6) the so-called Hassall's corpuscles and the polymorphic fixed reticular elements of the gland are definitely entodermal in origin. The lymphocytes are supposed by Stoehr (7) to be due to a partition of the epithelial cells while Hammar and Maximow (8) believe that they arise from a secondary ingrowth of mesodermal elements.

The average weight of the thymus gland at birth is 12 grams (Hammar) and it increases after birth according to Hammar, V. Sury, Schridde, Ronconi, Pappenheimer, and others, until sexual maturity. The thymus tissue gradually atrophies and is partly replaced by fat, although appreciable remnants of thymus tissue are retained until late life. Accidental involution may occur in fasting animals (Hammar and Jonson, 9), and after irradiation with X-rays (Ribadeau, 10), and in chronic diseases associated with marasmus.

Little is known about the physiology of the thymus gland. It would seem from the experimental work of Klose and Vogt (Basch, 11), H. Mathi (12), and others that it is intimately related directly or indirectly with the calcium metabolism. This influence is predominant in the early weeks of life, later becoming negligible. After complete thymectomy in dogs only a few days old, growth became retarded as compared with normal animals. The bones became more flexible and ossification was retarded. Callus formation was very poor. Calcium elimination was essentially increased. Dentition was delayed and an increase in the body fat was seen (stadium adipositas). This was followed by a gradual loss in weight in spite of increased appetite, muscular tremors, apathy, inco-ordination due to degenerative changes in the spinal cord, anæmia affecting both reds and hæmoglobin, and a failure of the leucocytes to respond to the injection of chemotactic agents. Death finally occurred in coma.

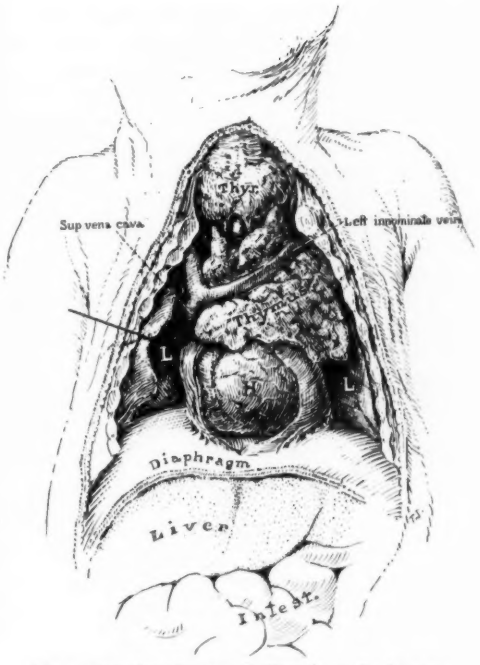

Fig. 1. Drawing showing findings in author's case.

Mathi also describes a broadening of the medullary portion of the adrenal gland and enlargement of the thyroid and pancreas.

When the same operation is performed on somewhat older animals serious disturbances of growth occur which disappear later.

When we turn to the pathology of the thymus gland we find again little exact data, and conflicting views advanced by many different authors. Aplasia of the gland is sometimes found. The condition is not infrequently associated with other malformations, especially with brain defects (Winslow, 13; Katz, 14; Bourneville, 15, and others). Total extirpation of the thymus has been carried out; but according to the experiments of Klose and Vogt (16) on animals it is not to be advised. In this connection the experience of Koenig (17) is interesting. The thymus was removed from a 9-months-old child for the relief of dyspnœa. The breathing became normal, and afterward there developed a severe rachitis on account of which the child first learned to walk at 4 years of age.

The condition of greatest clinical interest, however, is thymus hyperplasia. From a review of the opinions of the various authors it would seem that the thymus death cases may be grouped into two great classes:

Status thymicus. A group of cases in which the thymus gland is greatly hyperplastic and gives clinical and anatomical evidence of compression of the great vessels, nerves, and trachea. In these cases there is no change in other glands or organs of the body. Several cases have been operated upon with removal of greater or lesser amounts of the thymic tissue, and often with good results. L. Rehn (5) has had several cases in which the clinical picture was that of tracheal stenosis, in some of which a tracheotomy had been done without relieving the symptoms, because the stenosis was too low. He says further that the trachea may be compressed at various levels, but the most constant and most extreme degrees of compression are noted where the innominate artery crosses the trachea. He believes that the compression of the trachea may be increased in these cases in several ways: First, by the bending back of the head, causing an acute lordosis and thereby lessening the critical space. Second, acute swelling due to active or passive congestion of the gland. He mentions, as such, cases of sudden death following the tying off of the arteries or veins at the lower pole of the thyroid during thyroidectomy. He quotes Gluck and Dwornitschenko to the same effect. Third, swellings of the gland occurring in the acute infectious diseases, especially diphtheria. Heinrichs (18) reports a case in which the enlarged thymus caused dysphagia as well as dyspnœa.

Some evidence has been advanced for the view that in certain cases the compression of the great vessels is the most important factor in the cause of death. Thus Hans Cohn (19) reports a case of death in a 7-months-old child following a slight cold. Cyanosis and dyspnœa developed with no lung findings. The heart was found to be greatly hypertrophied and enlarged and there was great dilatation of the branches of the aorta. Lange (20) reports a similar case in which slight symptoms had been present for 8 months. At autopsy the thymus gland was found surrounding the great vessels and the bifurcation of the trachea. There was no evidence of compression of the air passages, but the great vessels were greatly flattened and the heart was greatly dilated and hypertrophied. Zander and Keyhl (21) report an interesting case in which clinically there was dyspnœa with slow pulse but without cyanosis. The autopsy showed a thrombosis of the left internal jugular vein for one-half inch at its entrance into the thorax. Also a greatly enlarged thymus, especially in its anteroposterior diameter. Caillé (22) reports a similar case with convulsions.

Status thymico lymphaticus. The second great group are the cases in which an enlarged thymus is found in association with a general enlargement of the lymphatic tissue and frequently changes in the other ductless glands. Another very important finding in these conditions according to Wiesel (23) and Hedinger (24) is an associated hyperplasia of the chromaffin tissue of the body. A. Paltauf (25) also drew attention to the associated narrowing of the vascular system in these cases.

It would seem from this view of the condition of thymic death that a careful distinction must be made as to the cause of the death in a given case. The dogmatic statement of

Friedleben (26) that there exists no thymic asthma is wrong; also the view of Paltauf that all cases are to be regarded as of lymphatochlorotic constitution is incorrect. We must agree with Jacobi when he says that pressure from an acute congestion of the thymus on the trachea, great vessels, and nerves explains a certain number of these cases of thymic death but not all. Virchow (27) and Cohnheim (28) both state that the thymus can cause tracheal stenosis. Brouardel (29) points out that erroneous conclusions may be drawn at autopsy because the trachea and bronchi regain their cylindrical shape after removal of the sternum, even if they were compressed before. L. Rehn calls attention to the same point and believes that all cases should be hardened before opening the thorax in order to preserve the proper relations.

Halstead (30) has called attention to the association of thymus hyperplasia and Basedow's disease. He quotes Garré's (31) figures gathered by his assistant Dr. Chapelle in which a thymus persistens hyperplastica was found in 95 per cent of fatal cases of Basedow's disease, whether death was due simply to the severity of the disease or occurred during operation, or within 24 hours after strumectomy. Three primary thymectomies have been done in Garré's clinic for the relief of symptoms of Basedow's disease with good effects on the general condition and the blood picture in each case. Von Haberer (32) reports a very interesting case in which a man of 30 years suffered for 3 years with symptoms of exophthalmic goiter. During this time he had had a part of the gland removed and the arteries of the remaining lobe tied off at a secondary operation. He presented himself at von Haberer's clinic in a state of collapse so severe that operation was at first refused and only eventually undertaken as a last resort in response to the pleadings of the patient. A small piece of thymus tissue was removed 3 cm. x 0.5 cm. under local anæsthesia. Complete recovery followed.

Halstead concludes that the thymus gland may play an important part in Graves' disease and in certain cases may play the title rôle, and that some of the puzzling features of this disease may be interpreted by the discovery of the influence that the thymus may excite. He quotes the experiments of Gudernatsch, who fed to groups of tadpoles equally developed thymus and thyroid. Those receiving thymus increased greatly in size without differentiation or change of form. Those receiving thyroid put forth arms and legs and rapidly took on the characteristics of the frog.

The enlargement of the thymus gland in association with diseased conditions of other ductless glands is to be noted. According to Falta (33) it is found to have supernormal parenchymal value in many cases of Basedow's disease, also in acromegaly, in hypophysial dystrophy, in myxœdema, in eunichoidism, etc. Obviously, therefore, since it occurs in conditions of hypofunction as well as hyperfunction of these glands the real significance of the hyperplasia is difficult to determine.

A peculiar group of cases has been reported occurring in families, several children dying with the classical symptom-complex of hyperplasia of the thymus.

The symptoms in this condition are those referable to an enlarged thymus causing pressure upon the mediastinal structures with or without the associated changes found in status lymphaticus according to whether the condition is a status lymphaticus with especially large thymus or a pure status thymicus.

The onset varies in different cases. Symptoms may be present at or shortly after birth, and usually appear during the first year. They may appear suddenly in a previously apparently normal child or gradually and with increasing severity. The cases of sudden death without any premonitory symptoms are usually cases of status lymphaticus plus thymus hyperplasia.

The symptoms referable to the enlarged gland are *dyspnœa* either constant or paroxysmal, usually aggravated by exertion, such as crying, fits of anger, sudden retraction of the head, or in association with attacks of acute infectious diseases, especially diphtheria. *Cyanosis* which is usually associated with the dyspnœa and is likewise paroxysmal and is partly due to the narrowing of the air passages, pressure on the vagus nerves and on the heart

and great vessels. This may be the only symptom giving rise to the "forme cyanotique" of Marfan. *Tumor* appearing in the suprasternal notch on strong expiration and disappearing on inspiration. *Slow pulse* in some cases probably due to pressure stimulation of the vagus nerve. *Changes in the voice* which vary from a slight and transient hoarseness to a complete aphonia, due in some cases to pressure on the trachea and larynx and in others to pressure on the recurrent laryngeal nerves. *Dysphagia* may in extreme cases completely prevent swallowing.

Physical findings. Inspiration and expiration may be prolonged and deepened,and auscultatory findings of a capillary bronchitis are common which may go on to a bronchopneumonia, especially in the late stages of the fatal cases. Percussion may reveal a movable tumor behind the sternum, but results obtained by this method are not very reliable, as pointed out by Park and McGuire (34). Radiograms may show a shadow in the region of the thymus which blends with that of the upper border of the heart. The gland may be palpated in the suprasternal notch on expiration in some cases.

Blood findings. There may be a lymphocytosis which is usually of the small mononuclear type and may reach 50 or 60 per cent. Eosinophilia in slight degree (2 to 4 per cent) is noted in some cases. According to Wiesel (23) this finding is absent in the cases of pure status thymicus.

In the cases associated with the typical status lymphaticus, the above symptoms may be displayed, but usually are present in less degree, and the predominating feature of these cases is the picture of status lymphaticus with the enlargement of the lymphatic structures of the whole body, pasty skin, adiposity, and associated changes in the chromaffin system. These are the cases particularly in which sudden death occurs without prodrones.

The diagnosis of this condition is based upon the foregoing symptoms combined with the physical findings. Of special interest is the warning of Klose and others against prolonged exposure of the thymic region in young children to the X-ray because of the destruction of thymic tissue by the irradiation.

Park and McGuire (34) call attention to the difficulty of accurately mapping out the thymus by the clinical methods available. They believe the thymus to be a relatively immobile organ and that the movable dullness obtained on percussion is probably due to the upward advance of the lung margins.

Jacobi (4) advises percussion of the thymus region with the child in the prone position. Boggs (35) believes that the gland is movable and that this can be demonstrated by percussion. The lower border of the gland moves as much as in interspace when the head is moved from extreme flexion to extreme extension, with the patient in the sitting position. He also points out that dullness due to enlarged thymus is higher and more superficial than that due to diseased mediastinal lymph-glands or other forms of mediastinitis. Thymic dullness also extends more to the left of the sternum than to the right. Emmerson (36) believes that both percussion and radioscopy have limitations, and that they are of less value in older patients. If we bear in mind the great morphological variations in the gland this view is strengthened.

Differential diagnosis would have to include enlarged mediastinal lymph-glands from various causes, mediastinal abscess, benign and malignant tumors invading the mediastinal space, congenital cardiac lesions, hyperplasia of aberrant retrosternal thyroid, congenital stenosis of the œsophagus, laryngismus stridulus, laryngeal diphtheria, spasm of the glottis in parathyroid insufficiency, and aneurism of the arch of the aorta. The differentiation is usually easy with the symptoms and physical signs given above, and of especial value are the X-ray and fluoroscope. The bronchoscope is of value in diagnosing the tracheostenosis in older children.

The treatment of the condition is removal of part of the gland in the cases where pressure causing tracheostenosis threatens life. This can be accomplished by entering the thorax above the suprasternal notch, under local or general anæsthesia, according to the demands of the individual case. Care must

be taken not to remove the whole gland in very young children because of the metabolic disturbances engendered, as in the case of Koenig, and as shown by the experimental work of Klose and Vogt. "Thymectomy subtotale souscapsulaire," described by Veau and Olivier (52), is the operation of choice. C. A. Parker (53) has given an excellent review of the surgical literature up to 1913, and he describes this operation and reports a successful case of his own.

Irradiation with the X-ray has been tried by Friedlander (37), Mayers (38), Halstead, Ribideau, Rachford (39), and with some success. Its use should be restricted to older children and adults for the reasons mentioned above.

No uniform results have been obtained from treating these cases with thyroid extract and thymus tissue. Spontaneous recovery occurs not infrequently even after several attacks of dyspnœa extending over years (L. Rehn).

Care must be exercised in operating on cases showing evidence of status lymphaticus as well as enlarged thymus as it is in these cases that sudden death during narcosis so frequently occurs.

Also as illustrated by this case reported below surgeons should keep in mind the possible anomalous position of the mediastinal blood-vessels with a view to avoiding injury to the same with serious consequences.

The following observations were made on a case of thymic death which apparently falls in the group of status thymicus, and which is associated with a rare anomaly of the left vena innominata. Unfortunately I did not see the case before death, and therefore have to depend on the statements of others, who did not make detailed observations, and on the rather incomplete clinical records on the history sheet.

The history is as follows:

Full-term pregnancy in a primiparous woman 24 years old. Labor was normal in every respect; presentation was cephalic occipitolævo-anterior, and terminated spontaneously in 36 hours. The baby breathed spontaneously, and no difficulty in breathing occurred until about 2 hours after delivery when it was noticed that the respirations were somewhat difficult and that the child was cyanotic. This condition prevailed for about 2 hours when the cyanosis deepened, the respirations became more difficult, and the child died. There were no convulsions. Ante-partum and post-partum the heart-tones were normal. Just before death the pulse went down to 30 per minute. No other observations of the baby's pulse were made. A tentative diagnosis of patent foramen ovale was made. An autopsy was performed 5 days after death—the body in the interval being kept on ice.

Autopsy record in brief. The body is that of a well-nourished male infant 50 cm. long, weight 4 pounds 14 ounces. The skin of the head and neck, arms, and thorax appears red and congested. There are no deformities. The superficial lymphatics are not enlarged. The testicles are descended. The head shows no signs of trauma.

On opening the body there is present a moderate amount of subcutaneous fat. The pericardial sac contains a large amount of serosanguinous fluid. The pleural cavities are normal. The abdominal cavity is negative. The left lung is compressed and pushed to one side by a large thymus, which is a heart-shaped organ situated slightly to the left of the median line and extends from the lower border of the thyroid above to the fourth rib below. It is 4 cm. broad at its widest part and 5¼ cm. long. Crossing the upper portion of the thymus from left to right at the upper border of the clavicle to the level of the lower border of the first rib is the left innominate vein. This has compressed the thymus, and lies in a groove on its surface. A branch of this vein leaves the thymus tissue at about the mid-line of the body.

The inferior thyroid vein empties into the left innomimate vein at the left border of that portion of the thymus lying above this vein. About ¼ cm. above this junction it receives a large branch from the thymus. There is no evidence of thrombosis in the thymic veins, left innominate, or superior vena cava.

The weight of the thymus could not be determined because of the desire to preserve the specimen intact. (Moreover according to Scheele (40) the weight of the gland has little to do with its power to compress the trachea.)

There are subepicardial petechial hæmorrhages present in the heart, and it appears normal in size. The ventricular septum is intact, and the foramen ovale is closed by a septum. The ductus arteriosus is present and patent. The posterior portions of both lungs are markedly œdematous in all lobes. The anterior portions are lighter in color and contain less fluid. Œdema of the posterior portion of the lung is more marked on the left side. The kidneys are normal in size, and show fœtal lobulations. Cortical petechial hæmorrhages are noted. The adrenals show no gross lesions, and are not enlarged. The liver and gall-bladder are about normal in size and there are no gross lesions. The spleen is normal in size, shape, and consistency. Extremities are negative. There are no scars or deformities. The

stomach and intestines are negative. The cranial cavity was opened after the brain was allowed to harden in Kaiserling I solution for 2 days.

The head measurements are as follows: 13.5 M.O., 11.5 F.O., 9.5 S.O.B., 9.0 B.P., 8.5 B.T.

The fontanelles are open and normal in size.

The hypophysis is normal in size. There is no cerebral or meningeal hæmorrhage and no evidence of inflammation or trauma.

Histological examination made of the hypophysis, thymus, thyroid, adrenal, and spleen revealed no abnormalities.

The trachea was opened just above the upper edge of the main portion of the gland. There was evidence of compression of the trachea by the main body of the thymus, as shown by the difficulty of passing a probe downward from the opening, compared with that of passing a probe upward from the opening.

The anomalous vein in this case was the left innominate. This vein normally is situated posterior to the thymus and joins the right innominate to form the superior vena cava just above the bifurcation of the trachea. In this case the vein extended anterior to the gland and lay in a groove on its anterior surface.

This condition is not common, judging from the number of reports in the literature (41). K. Hart reports a similar case in which the thymus was normal in size. V. Mettenheimer (42) also reports such a case and thinks there may have been compression between the gland and the sternum. Forret (43) and Dwornitschenko (44) each report a case. L. Rehn in commenting on V. Mettenheimer's case thinks that the vein came to lie anterior to the gland by causing pressure atrophy of the gland substance and cutting through from the posterior to the anterior side of the gland.

Kayser (45) found a carotid extending over a prolongation of the thymus in the anterior surface of which it had cut a groove and the thymus tissue had been replaced by scar-tissue.

The prolongation of the upper lobes of the thymus into the neck is considered anomalous by some authors and not by others. Thus L. S. Dugeon says "The main portion of the gland is situated within the thorax but both lobes send prolongations upward for a short distance into the neck, sometimes reaching to the thyroid." Reiffel and LeMeé (46) in 34 cases found the thymus extending to the thyroid in one-fifth of the cases.

Weber (47) and Kuersteiner (48) found the prolongation of the right lobe most common, while Winslow and Cruchet (49) found the left lobe most frequently involved. The latter found this condition present in 10 out of 59 cases and says the thymus tissue is often represented by a fibrous band. Piersol (50) calls this band a suspensory ligament. In some cases, N. B. Harmon, the gland tissue extends along the great vessels to the root of the tongue and bifurcation of the carotid. G. Bien (51) cites cases in which the gland tissue was intimately associated with the vagi nerves.

A. Hammar on the other hand says that any elongation of either pole of the thymus is an anomaly and represents a reversion to the type seen normally in the lower animals, especially birds and reptiles.

This article is necessarily not exhaustive. It is an attempt on the part of the writer to assemble and correlate the work of a great number of men who have worked on various phases of the subject so that we may have a clearer idea of the subject as a whole as it presents itself to the clinician. I should like to point out the great need in future work along this line of complete data. Each case should be investigated exhaustively from the standpoint of anatomy, pathology, and histology of the thymus, and the possible changes in other glands and tissues of the body noted. Such data together with careful clinical notes and history subsequent to operation will greatly assist in clarifying this interesting field.

The condition is not difficult of recognition clinically for one who is familiar with its signs and symptoms.

Operation with removal of a portion of the gland is of benefit in the cases of pure status thymicus which are accompanied by severe pressure symptoms.

Tracheotomy and intubation are of little value in most cases because the compression of the trachea is too low down.

The possibility of aberrant vessels, as in the case here reported, should be kept in mind by the surgeon to avoid injury to the same.

As to the advisability of and the benefits to be derived from operation on the thymus in cases of status lymphaticus with enlarged thymus, it is very doubtful if the operation should be undertaken except in the cases in which there is severe tracheostenosis.

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UTERINE HÆMORRHAGES

WITH SPECIAL REFERENCE TO ACTINOTHERAPY

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GENERAL CONSIDERATIONS

THERE are two kinds of uterine hæmorrhage: the one which is periodical and associated with the menses is termed menorrhagia (monthly bleeding); the other occurring at irregular intervals and independent of the menstrual flow is known as metrorrhagia (uterine bleeding). The two conditions may be easily differentiated or it may not be possible to discriminate one from the other. But this is not of any clinical importance, as the one may be a degree of the other and we may term both "uterine hæmorrhage." Whether the menstrual flow is too profuse, lasts too long, or is too frequent should be determined by a careful interrogation of the patient, taking into consideration the number of napkins used, the character of the blood (whether arterial or coagulated), the duration of the flow, and finally the determination of the onset of each hæmorrhage.

ETIOLOGY

The causes of uterine hæmorrhage are (1) accidents of pregnancy, labor, and puerperium; (2) functional derangements of the genital organs without any demonstrable

Case No.	Name	Age	Civil State	Para	Duration of Hæmorrhage	Diagnosis	Date of Treatment	Kind of Treatment	Immediate Result	Remote Result
1a	Mrs. G.	56	M.	V	Ten years	Myomata uteri	June 15, 1913	X-ray 200-X	Amenorrhœa	Nov. 30, 1915. Well. Mild change of life.
2a	Mrs. S.	47	M.	O	Four years	Myomata uteri	Jan. 20, 1914	X-ray 300-X	Amenorrhœa	Dec. 4, 1915. Well. Stormy climax.
3a	Mrs. T.	46	M.	I	Six years	Hyperplasia uteri	Dec., 1913	X-ray 260-X	Amenorrhœa	Nov. 2, 1915. Well. Mild climax. Uterus atrophic.
4a	Mrs. G.	40	M.	V	Three years	Myomata uteri	April 13, 1914	X-ray 200-X	Amenorrhœa	Mild climax.
5a	Miss M.	38	S.	O	Several years	Myomata uteri	June 30, 1915	X-ray 240-X	Amenorrhœa	Nov. 23, 1915. Well. Mild climax.
6a	Mrs. K.	48	M.	IV	Eight years	Hyperplasia uteri	May 28, 1914	X-ray 300-X	Amenorrhœa	Nov., 1915. Well. Severe climax.
2	Mrs. N.	45	M.	III	Four months	Hyperplasia uteri	Sept. 21, 1914	Radium 1000 mgh.	Amenorrhœa	Well. Mild climax.
42	Mrs. P.	38	M.	O	Six months	Myomata uteri	Oct. 28, 1914	Radium 1200 mgh.	Amenorrhœa	Nov., 1915. Well. Tumor reduced from child's head to lemon.
44	Mrs. E.	38	M.	IX	One year	Metropathia hæmorrhagica.	Nov. 4, 1914	Radium 1050 mgh.	Amenorrhœa	Nov., 1915, delivered of normal child at full term.
53	Mrs. B.	50	M.	VI	Six years	Myomata uteri	Dec. 7, 1914	Radium 2000 mgh.	Amenorrhœa	Well. Very mild climax.
72	Mrs. M. E. C.	50	M.	I	Three months	Myomata uteri	Feb. 19, 1915	Radium 1150 mgh.	*Hæmorrhages reappeared*	*Mar. 8. Hysterectomy. Red degeneration.*
92	Miss E.	45	S.	O	Three months	Hyperplasia uteri	Mar. 3, 1915	Radium 2050 mgh.	Amenorrhœa	Nov. 15, 1915, complete amenorrhœa. Uterus normal.
93	Miss C.	39	S.	O	Several years	Metropathia hæmorrhagica.	April 6, 1915	Radium 1800 mgh.	Amenorrhœa	Dec. 2, 1915. Well. Very mild climax.
95	Mrs. F.	38	M.	III	Two years	Myomata uteri	Feb. 19, 1915	Radium 1250 mgh.	Amenorrhœa	Well. Average climax.
97	Mrs. B.	65	M.	V	Ten years	Myomata uteri Cystoma ovarii.	May 4, 1915	Radium 1500 mgh.	Amenorrhœa	Died Nov. 22, 1915, after ovariectomy, but had complete amenorrhœa. Uterus but slightly enlarged. Tumor almost gone.
102	Mrs. P.	32	M.	O	One year	Myomata uteri	May 21, 1915	Radium 1200 mgh.	*Profuse menses*	*Tumors are growing. Ought again to be treated.*
137	Mrs. D.	45	M.	XII	Three years	Myomata uteri	Sept. 29, 1915	Radium 600 mgh.	Amenorrhœa	One pedunculated tumor removed. Dec. 1, well.
142	Mrs. S.	50	M.	IV	Eighteen days	Hyperplasia uteri	Oct. 8, 1915	Radium 1600 mgh.	Amenorrhœa	Dec. 6, 1915. Amenorrhœa.

pathology; (3) diseases of the generative organs with a demonstrable pathology; (4) general constitutional or systemic diseases; and (5) vascular disturbances.

The accidents of pregnancy, labor, and puerperium belong to the domain of obstetrics and will not be considered in this paper. Such disturbances are abortions, either threatened or incomplete, extra-uterine pregnancy, placenta prævia, premature detachment of the placenta, atony of the uterus during or following the placental stage of labor, injuries of the uterus, retained oval membranes, subinvolution, etc. If a uterine hæmorrhage unexpectedly occurs in a married woman, the possibility of an abortion or extra-uterine gestation should always be considered.

The *functional disturbances* of the genital organs depend in all probability on a dysfunction of the internal secretion of the ovaries and other ductless glands. We know from animal experimentation and clinical observation that hormones of certain ductless glands either inhibit or stimulate ovarian internal secretion; for instance hyperpituitarism causes amenorrhœa, and finally sterility and atrophy of the genital organs. Hyperthyroidism is usually accompanied by amenorrhœa, while hypothyroidism is often associated with uterine hæmorrhages. In other words, in-

creased activity of the thyroid gland leads to a decreased activity of the internal secretion of the ovary, and decreased thyroid gland activity results in an hyperfunction of the ovary.

The *diseases of the uterus and adnexa* accompanied by uterine hæmorrhages are: (1) *Circulatory disturbances* resulting in a hyperplasia of the genital organs. They are brought about by (a) trauma and subsequent scar formation, as lacerations of the cervix, inflammatory cicatrices from necrosis and gangrene, hæmatoma, and hæmatocele; (b) displacements and deformities, as flexions, versions, rotations, torsions, inversion, prolapse, and hernia formation; (c) tumors, leading to an obstruction of the blood and lymph circulation; (d) obstinate and habitual constipation; and (e) active hyperæmia from perversions of sexual and marital life. (2) *Inflammations* of the pelvic organs as gonorrhœal, septic, and tuberculous infection. (3) *New-growths* of the uterus as carcinoma, sarcoma, chorio-epithelioma, myoma, and adenomyoma.

General constitutional or systemic diseases are the anæmias (while chlorosis causes oligomenorrhœa or amenorrhœa); chronic poisonings, as lead, alcohol, and phosphorous poisoning; acute infectious diseases, as cholera, smallpox, malaria, typhoid, and scarlet fever, also scurvy, rheumatoid diathesis and hæmophilia.

Vascular disturbances are the result of chronic cardiac, hepatic, and nephritic disease.

Out of 643 consecutive gynecological cases that came under my observation at the St. Mary's (199) and Willard (444) hospitals, 135 or 21 per cent were accompanied by uterine hæmorrhage due to an underlying genital disease. The diseases associated with uterine hæmorrhage are:

Carcinoma uteri	19 cases or	14.1 per cent
Chronic adnexitis	16 cases or	11.8 per cent
Hyperplasia of the endometrium	13 cases or	9.7 per cent
Myomata uteri	11 cases or	8.1 per cent
Hyperplasia of myometrium	11 cases or	8.1 per cent
Retroflexio uteri	11 cases or	8.1 per cent
Abortion	10 cases or	7.4 per cent
Descensus uteri	9 cases or	6.7 per cent
Oophoritis and ovarian tumors	8 cases or	5.9 per cent
Chronic cervicitis with lacerations	6 cases or	4.4 per cent
Hæmorrhagic metropathy	6 cases or	4.4 per cent
Extra-uterine pregnancy	5 cases or	3.7 per cent
Endometritis post-abortum	4 cases or	3.0 per cent
Subinvolution of uterus	4 cases or	3.0 per cent
Sarcoma uteri	2 cases or	1.5 per cent

Fifty-six out of these 135 cases are characterized by a proliferation of uterine tissue. Thirty-two or more than one-half of the 56 are caused by new-growths and of these 19 are the result of carcinomatous formations. If we add to these 56 cases the 6 cases of hæmorrhagic metropathy or essential hæmorrhages, we obtain a total of 62 cases which formerly indicated repeated curettages and finally hysterectomies to relieve the patient. The cancers and myomata, of course, were always extirpated if operable.

DIAGNOSIS

A correct diagnosis of the underlying disease in uterine hæmorrhages is of the utmost importance. It can only be rendered by a microscopic examination of the endometrium or excised pieces of uterine tissue. A careful general and special pelvic examination will be a valuable adjunct. Carelessness in diagnosis leads to procrastination which has often changed a favorable into a hopeless prognosis. Incipient malignancy can only be recognized in this manner. At this stage the malignancy is localized and can be easily and completely eradicated, and an anatomical cure is thus assured.

TREATMENT

It is not my object to discuss the treatment of the immediate arrest of uterine hæmorrhages at the time of their occurrence or describe the technique of a curettage or of a hysterectomy. The purpose of this study is to call your attention to the curative action of actinotherapy or radiotherapy in treating uterine hæmorrhage. If we subtract from the 62 cases mentioned above the 21 cases of malignancy, we have left 41 cases of uterine hæmorrhage which had existed for a long period of time and resisted all usual treatment. Formerly the majority of these women had to be hysterectomized to bring about a cessation of the hæmorrhage. Six patients were treated with the massive roentgen rays and 12 with radium. The accompanying table gives all the data necessary.

Technique. A course of X-ray treatment consists of 6 séances each of about one hour's duration, given on six succeeding days. Water-cooled tubes of a diameter of 7 inches and a hardness of 7 to 9 Heinz Bauer are charged with a current of 2 to 3 milliampères. The focal distance of the tube from the patient is 21 cm. The rays are filtered through an aluminum plate of 3 mm. thickness. Six different fields, each 5 cm. square, are drawn upon the suprapubic region. Thirty to forty X are applied to each field. The amount of X used is determined by a Holzknecht radiometer. The applications are preferably made during the week following the cessation of menstruation. Usually one such course of treatment suffices to produce amenorrhœa. If this should not occur, a second course is given after three weeks, which invariably brings about the desired result. Concomitant symptoms are mild. They usually consist of nausea or diarrhœa, but are of a transient nature.

Only the γ-rays of radium are employed in the treatment of uterine hæmorrhages. The α-and β-rays are arrested by a lead filter of the thickness of 2 mm.; the secondary or Sagnac rays, forming in the heavy metal filter, which resemble the soft β-rays of radium, are absorbed by a pure para rubber filter of 1 mm. thickness. The average amount of milligram hours of radium element necessary to cause amenorrhœa is 1,000. If 50 milligrams of radium element are employed, it will take twenty hours to obtain this milligramage. The patient is prepared as for any operation: one-quarter of a grain of morphine is given hyperdermically about one-half hour prior to the time the application is to be made. The field around the vagina is rendered sterile, the cervical canal dilated, the endometrium is curetted for diagnostic purposes, and the radium capsule is then placed in the uterine cavity. A small chain or silk thread is left attached to the capsule to facilitate its removal. On an average 1,000 milligram hours suffice to bring about amenorrhœa. If the patient should still flow at a subsequent period, the application may be repeated after four to six weeks.

I repeat the necessity of a diagnostic curettage to exclude malignancy before the treatment with the roentgen or radium rays is begun.

The *indications* for this treatment followed by me are as follows: Essential uterine hæmorrhages and hyperplasia of endometrium and myometrium. In a patient of 35 years or older, failure of medicinal and local mechanical treatment to bring about cessation of the hæmorrhages. If repeated curettages in women below 35 years of age do not result in a cure, then actinotherapy is also indicated.

Myomata uteri. Myomata of the cervical submucous or pedunculated varieties and myomata undergoing degenerations must be treated surgically. Women below 35 years of age desiring off-spring are myomectomized. All other myomata are subjected to actinotherapy, which invariably causes amenorrhœa. The tumor decreases in size and often disappears entirely.

Radium is preferable to the X-ray. Radium destroys the endometrium; the roentgen ray causes a cessation of ovarian activity. The symptoms of change of life are, therefore, mild after the former treatment, while they are very pronounced after the roentgen treatment. The latter requires much more time for its application and is more expensive than the use of radium which necessitates an interruption of the daily routine of the patient for only twenty-four hours. Both methods, when properly used, are devoid of danger. Should contra-indications to surgical measures exist, as heart disease, general constitutional disease, etc., actinotherapy can still be safely and successfully employed.

PYELITIS OF PREGNANCY, WITH ESPECIAL REFERENCE TO ITS ETIOLOGY[1]

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THE first description of this infection seems to have appeared in Smellie's *Midwifery*, in 1752. Rayer described it in detail in 1842. Until quite recently, the condition did not attract the attention which its frequency and importance demand. Reblaub reopened the subject in 1892, reporting several cases and discussing the treatment. Since the publication of his article there have appeared a number of papers on the subject. The frequency with which infection of the pelvis of the kidney, and even of the kidney parenchyma, occurs, and the danger which its appearance often brings with it, are not yet generally appreciated. Undoubtedly many cases are entirely unrecognized, and every one who has had much obstetrical experience is aware of instances in which it has been confused with appendicitis, or has seen cases of rise of temperature in the puerperium which have been looked upon as puerperal fever, but which in reality have been infections of the kidney. Careful examination of the urine, coupled with painstaking physical examination, will almost invariably make it possible to differentiate infections of the kidney from either of these.

Considerable difference of opinion has existed among those who have written upon the subject as to the exact pathogenesis of the disease. Some writers have held the view that the infection is an ascending one originating in the bladder and traveling up the ureter either within its lumen or by way of its lympatic channels. Another and considerably larger group believe that the infection is a blood-borne one. Certain mechanical and anatomic factors are to be considered. The infection is, with rare exceptions, right sided. This is explained by the fact that the right ureter is pressed upon at the brim of the pelvis by the pregnant uterus which often inclines to the right. The uterus, as it rises out of the pelvis, passes before the mesentery and is deflected toward the right side. The same factor also, in a measure, protects the left ureter from pressure. Mirabeaux believes that the proximity of the ascending colon to the more freely movable right kidney has an influence upon determining the frequency of right-sided infections. While most authors affirm the possibility of mechanical obstruction being produced by the pregnant uterus pressing upon the ureter, a recent textbook rather scouts this theory, the author believing that kinks or bends in the ureter, rather than pressure, produce the obstruction. He bases this view upon the fact that the specific gravity of the pregnant uterus and that of the other abdominal contents are the same, and that therefore obstructive pressure would not be possible. That mechanical obstruction of the ureter is an undoubted fact, would be demonstrated by the following observation made upon a case seen through the courtesy of Dr. W. G. Alexander:

> The woman was four months pregnant. She had a right-sided pyelitis, and pus with little or no epithelium had been found in her urine by her physician. At the time she was seen, she had severe pain over the right kidney, and, shortly before my examination, the urine has been found to contain no pus. She was cystoscoped and an attempt made to collect the urines separately. The catheter passed up the left ureter easily and perfectly clear urine began immediately to flow. The catheter passed into the right ureter and ascended about ten centimeters from the bladder, when it stopped and could not be passed farther. The patient was then turned upon the left side in order to permit the uterus to gravitate away from the ureter, when the catheter passed upward to the kidney pelvis without the least difficulty and turbid urine began at once to flow. It did not flow intermittently, as is usual when the kidney pelvis is not distended, but came steadily and rapidly until a large test tube was filled. There was, therefore, certainly a distended kidney pelvis, and, if the obstruction would not allow the catheter to pass upward, it certainly would be sufficient to keep urine

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from flowing down. Further, after the kidney pelvis had been drained through the catheter, the pain in the back on the right side disappeared and the patient stated that she was more comfortable than she had been for some time. Cultures which were made from the urine obtained from this case will be referred to later.

Crew reports a case in which abdominal pain, vomiting, fever, rapid pulse, and chills were present, but in which no pus appeared in the urine until abortion followed an exploratory laparotomy. The appearance of pus permitted a diagnosis of pyelitis to be made, this condition for some reason not having occurred to the examiner earlier. The ureter in this case evidently was obstructed by the uterus, the obstruction, which had not been recognized, being removed when the uterus was emptied.

All observers in this field agree that the bacillus coli is the almost invariable infecting organism. Other organisms, such as the streptococcus, staphylococcus, gonococcus, and even the tubercle bacillus have in infrequent cases been observed.

In order to determine what relation might exist between the bacteria present in the bladders of normal pregnant women and the pyelitis of pregnancy, the following observations were undertaken:

The urine was obtained from the bladders of normal gravidæ upon entering the hospital. The meatus urinarius was carefully sponged off not less than six times with pledgets wet with one per cent lysol. The urine was received in a sterile bottle protected by a sterile cotton stopper. The catheter was passed by a nurse who had made complete surgical preparation of her hands. Such specimens were obtained from fifty women. The urine was put through the usual clinical laboratory tests in order to determine its freedom from any evidence of pathologic conditions. A portion was then centrifuged in a sterile centrifuge tube and the sediment inoculated upon blood serum culture tubes. Of these fifty cultures thirty-two showed a pure growth of staphylococcus. Two showed a pure culture of colon bacillus. Three gave a growth of colon bacillus and staphylococcus, while thirteen gave no growth. Colon bacillus, therefore, was found in pure culture, or mixed with staphylococcus in five cases.

A further and more careful investigation was made covering fourteen additional cases in order to ascertian by more exact cultural methods whether the colon bacillus could not be more frequently found. These women were all catheterized after a complete surgical preparation for delivery, or after having been taken to the labor room. These specimens were for the most part obtained by a superintending nurse concerning whose asepsis there can be no question. A few were secured by the writer in the labor room after preparation and before any possible break of asepsis could have been caused by the restlessness of the patient. The meatus was wiped with a succession of ten separate pledgets soaked in one per cent lysol. The urine was received in a series of three test tubes which had been autoclaved and provided with cotton stoppers. These were examined chemically and microscopically, the findings in all cases being within the range of the normal. The first two tubes were discarded for cultural purposes, the last of the three only being used. Cultures were made as follows: Two tubes of agar were melted in the water bath and cooled. To one was added two cubic centimeters of human ascitic fluid, and after cooling to a temperature of 43° C., two cubic centimeters of urine was added with a sterile pipette and the mixture plated. To the other tube of melted agar was added, at the temperature of 43° C., two cubic centimeters of urine, and the mixture shaken and allowed to cool. In an agar slant to which had been added human ascitic fluid and goat's blood, the latter in order that hæmoglobin might not be absent, was placed two cubic centimeters of urine. From this culture tube, oxygen was removed by means of pyrogallic acid and sodium hydrate to permit the growth of anaerobic organisms.

Eight of these cultures gave a pure growth of the staphylococcus, two of them upon the ascites agar plate and four in the agar shake culture. These colonies were transferred to blood agar slants in order to verify the examination of the plate colonies. All transfer cultures from these plates gave pure

growth of staphylococcus. All were gram stained. Four urines were negative in all three cultures. One urine gave negative results in the ascites agar plate, and agar shake culture, but a slow growing organism appeared upon the surface of the anaerobic blood agar slant. On the eleventh day after inoculation a smear was made from this tube and small coccus-like bodies found, which stained by gram, but were not recognizable. A transfer culture was made upon an aerobic blood ascites agar slant and after three days a smear showed a pure growth of pseudo-diphtheria. No anaerobic cultures or agar shake tubes were considered sterile until ten days had elapsed without growth.

In one case there appeared no growth upon the agar plate and none in the agar shake. An aerobic blood agar slant showed an abundant gray, solid growth. This organism was a spore-forming bacillus about the size of the diphtheria bacillus. It grew very slowly anaerobically. A culture upon a blood agar slant showed marked hæmolysis in 24 hours which was more pronounced in 48 hours. A 24-hour culture in bouillon showed the organism to be slightly motile. A gram-stained preparation 24 hours old showed the organism irregularly arranged upon the slide, with slight tendency to chain formation. Spores were present in both ends of most of the organisms in this preparation. A smaller number showed but one spore in the middle of the organism. A gram-stained preparation from a 48-hour growth showed the same appearance of the individual organism, but a rather greater tendency to chain formation.

Cultures were made upon the following media with the accompanying cultural reactions: lactose litmus agar, no reaction; mannit litmus agar, no reaction; litmus milk, no reaction; dextrose litmus agar, a distinct red color after 24 hours, showing that in this medium the organism has an acid reaction.

This organism is in all probability not a pathogenic one, inasmuch as the woman from whose urine it was obtained was a perfectly healthy gravida who subsequently within twelve hours had an entirely normal labor which was followed by an uneventful puerperium. It must also have been present in very small numbers, for in only one of the four original cultures which were made from this case did it appear. If it had been present in any numbers, it must have appeared in the agar-shake culture and should have shown upon the agar ascites plate. It must probably be, therefore, looked upon as a chance finding. But its description and cultural reactions are included in order that comparison may be made by others who may be doing similar work. The bacteriology of the urine both in pregnancy and in other states is as yet by no means fully worked out.

In the second series of fourteen cultures there were found staphylococci in seven cases. One case gave a growth of pseudo-diphtheria, and one case gave a growth of a spore-forming bacillus positive to gram stain, motile, and having an acid reaction in dextrose-agar growth, showing no reaction in lactose agar, mannit agar, and litmus milk. In a series of sixty-four cultures, therefore, colon bacillus was found five times, which is considerably less frequently than has previously been reported. These five cases all occurred in the first series, none of them having occurred in the second series of much more carefully worked out cases. It may be justly questioned whether some contamination may not have occurred in the first series.

I have had the opportunity of obtaining specimens of urine by means of the ureteral catheter from two cases of pyelitis of pregnancy. Both of these cases gave a pure growth of colon bacillus. In one of these cases, the cultural reactions of the organism were worked out by the writer and were typical of the colon bacillus. In the other case, the same work was done by the pathologist of the hospital with a similar result. These two cases were therefore beyond question colon bacillus infections.

It is highly probable that the staphylococcus, which is so frequently found in the urine of gravidæ, is an organism of a very low degree of virulence. None of the women from whom these specimens were obtained showed any symptoms of trouble referable to the urinary tract, all women seeming to be other than entirely normal being excluded. It is probable, however, that these organisms did exist in the

bladder and did not come from the urethra, as the first portions of the urine contained in the first two tubes of the last series of fourteen cases, would, in passing through the catheter, wash away any infective material which might be deposited in the eye of the catheter while introducing it. The staphylococcus must, therefore, be looked upon as a frequent inhabitant of the bladders of pregnant women, but also as a relatively harmless one. I intend at a later date to inoculate some of these organisms into laboratory animals with a view to determining their virulence.

Loeppritz, in 1911, in a series of experiments upon the urine of pregnant women, has endeavored to show that two factors exist which give to the urine of pregnant women a certain degree of antiseptic power. First, its normal acidity; and second, a leucocytic bactericidal substance which may be destroyed by heating to 90° C. This substance exercises a decided influence upon the growth of staphylococcus and streptococcus, but affects the colon bacillus but little. This if true affords an additional explanation of the very low grade of virulence of the staphylococci so frequently found in the urinary tracts of gravidæ.

It has been suggested that the most exact cultural results might be secured by obtaining specimens from the bladder by means of a needle passed through the anterior vaginal wall in a spot which had previously been touched with iodine. I do not agree with this, for I do not see how contamination with Doederlein's bacillus, for example, or other vaginal flora may be entirely insured against. It can hardly be possible to eradicate all bacteria from the deeper portions of the mucosa any more than from the deeper layers of the skin by any form of surface antisepsis. I doubt whether it would be possible to obtain urine from the female bladder under any more effective precautions than were here used.

As to the question of the mode of entrance of the colon bacillus into the pelvis of the kidney, I believe that the infection is a blood-borne one. It has been urged that, as colon bacilli have not been found in the blood stream, the infection by this organism could not be a blood-borne one. Dick and Dick have shown that in nephritis of infective origin the organism causing the primary process may be recovered from the urine by cultural methods, although the blood culture may fail to demonstrate it in the blood stream. It is, therefore, possible for an organism to pass through the blood stream in numbers so small that cultural efforts to find it fail, and still grow secondarily in the kidney.

The distended and congested kidney which is found as a result of obstruction to the ureter forms a locus minoris resistentiæ, and colon bacilli which exist in enormous numbers in the large bowel may easily be deposited there by the blood stream.

Sieber experimented upon rabbits to determine whether an artificial obstruction to the ureter could influence the production of a pyelitis. He placed a loop of catgut in such a manner that it pulled upon but did not completely occlude the ureter. He then placed solutions of the animals own fæces in the bladder as well as irritating bodies, such as croton oil. His conclusion was that the infection was not an ascending one, although his previous view had been to the contrary.

While it cannot be assumed that the infection is invariably of hæmogenic origin, and I do not feel that I have proved that to be the case, I believe it may in the large majority of cases be looked upon as a blood-borne infection. Recent work upon focal infections of various kinds and their transmission to distant parts of the body must cause us to believe that this mode of transmission is much more frequent than was formerly believed to be.

Much has been written upon the treatment of the pyelitis of pregnancy. Many cases will respond sufficiently to palliative treatment alone. Postural treatment is of great value. If the patient be kept upon the right side or upon the abdomen the uterus will gravitate away from the right ureter, thereby allowing the kidney to drain. With this may be combined water in large amounts and hexamethylenamine in amounts sufficient to give a reaction for formaldehyde in the urine. If relief is not had within a short time, further means of combating the infection must be thought of.

Vaccines have proved to be disappointing. Certainly while obstruction exists no great result can logically be hoped for from their use. My experience with them has been limited and confined exclusively to the use of autogenous vaccines given after delivery or after the uterus has been emptied. As in such cases recovery usually follows spontaneously, it cannot be assumed that the vaccines were wholly or even in large part responsible for cure.

The ureter catheter is a valuable aid. Textbooks, as a rule, merely mention it. But a large number of European writers recommend it as of great value. By ureteral catheterization, a distended kidney pelvis may be drained and pain thereby greatly relieved. And in severe and stubborn cases the kidney pelvis may be irrigated and solutions of silver nitrate or other antiseptics instilled. This procedure may, if necessary, be repeated a number of times. Cystoscopy is, as a rule, not difficult in a pregnant woman, especially in the first half of pregnancy. It should however, be carried out with great caution, the instrument being introduced with the greatest possible gentleness, as cases of abortion after it are not unknown. The Kelly instrument cannot be used, as in pregnancy the knee-chest position is impossible on account of the large uterus falling forward upon the bladder. With a water instrument carefully used it may be successfully carried out. In cases in which, for any reason, the diagnosis is in doubt, this procedure will clearly demonstrate whether the kidney is at fault, and at the same time offers a means for at least temporary relief. It should not be used until postural treatment and the use of urinary antiseptics have failed.

If the infection advances to such a degree that the integrity of the renal parenchyma is believed to be in danger, more radical means must be considered. The induction of labor must in infrequent cases be resorted to. In the endeavor to escape this radical and unwelcome operation, a number of authors have tried and recommend nephrotomy. This has been done during pregnancy successfully by several writers, notably Opitz, Legueu, Kehrer, McDonald, E. P. Davis, and Cova. Davis reports three such cases. If necessary, a nephrectomy may be done later, but in several of these cases the renal fistula is said to have closed after delivery. In cases of severe infection in which the kidney has undergone irreparable damage, nephrectomy may be carried out during pregnancy. Cova reports twenty-three cases in which this operation was done during pregnancy successfully. In thirteen of these cases subsequent pregnancies occurred. It seems scarcely possible that such a procedure should be necessary or justifiable in a case which had been under competent observation from the start. In cases which are first seen after the development of a severe pyelonephritis it is conceivable that nephrectomy might be a necessary and justifiable procedure. My own view is that in cases in which the kidney seems likely to undergo damage sufficient in degree to render later nephrectomy necessary would present a reasonable indication for the induction of labor. One should consider carefully before allowing the infection to proceed, in a case which is seen early, to a point at which sacrifice of the kidney would be necessary.

Nephrotomy may be much more lightly undertaken, for here the kidney is preserved with a high degree of likelihood of its later resuming full functional activity. Barth believes that nephrotomy is preferable to induction of labor, and there is at least some justification for his view. But the extreme view of Stoeckel, that induction of labor is never necessary, can scarcely be supported, and is not concurred in by the majority of writers.

By far the most important thing in the treatment of this infection is its early recognition. And this depends upon careful observation and urine analysis on the part of the physician. If pyelitis be early recognized and the treatment be instituted immediately, a great majority of cases may be successfully carried through.

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DEPARTMENT OF TECHNIQUE

PRIMARY CARCINOMA OF THE URETHRA, RETENTION OF URINE FROM OBSTRUCTION, RESTORATION OF FUNCTION BY RADIUM

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THE occurrence of primary carcinoma of the urethra is so rare that all cases should be reported, and especially the influence which radium may exert on their relief is of interest.

L. S. McMurtry, after a search of the scanty literature, calls the urethra the "rarest location" for primary carcinoma. Many cases reported are merely extensions from other commoner localities and will not bear analysis.

Bringing previous searches down to date, he was able in his paper before the American Surgical Association,[1] to find but 26 cases, beginning with one reported by Madame Boivan in 1828.

F. von Winkel,[2] says that such carcinomatous neoplasms are of extremely rare occurrence, and those reported have usually spread from the external genitalia or the vagina. He saw two primary cases and says that in both a pavement epithelioma had undoubtedly started in the urethral mucosa. The second patient had urethral and vesical calculi and died of uræmia. He refers to four cases published by Melchiori and one by Roberi in 1869. Their observations were that periurethral cancer appeared as nodules in the vestibule and extended thence in the cellular tissue along the urethra, without, however, affecting the walls or the mucous membrane of the canal, the nodules being at first hard, painless, and non-ulcerating. In the earlier stage, they do not extend to the depth of more than half the length of the urethra; in the second stage, they reach the pelvic fascia and the neck of the bladder.

Sielman[3] mentions one case of carcinoma of the urethra as being considerably reduced in size, with relief of the accompanying dysuria, by application of X-rays. An interesting example of what radium may accomplish is reported by Legueu and Chéron[4] of Paris.

A woman age 26; pavement epithelioma; at first involving the urethra, which was destroyed producing incontinence; extension to vagina. Radium applications by Chéron with disappearance of growth. Two and a half years later, death under operation for implantation of ureters in bowel. Autopsy, no microscopical malignancy.

The writer would record his only experience as follows, all others seen being instances of involvement by extension.

Mrs. W., multipara, a full blood Virginia negress, aged 50 years, applied at the Presbyterian Hospital because of overdistention of the urinary bladder with complete retention. Beginning about five months before (July 1915) there had been some difficulty in urination gradually succeeded by dribbling. For more than a week bladder distention had been extreme, and on admission culminated in inability to pass any urine at all. There had been no bleeding or pain, except that due to the bladder condition.

No ordinary sized catheter could be introduced, owing to a nodular infiltration in and around the urethral canal. The urethra felt through the vagina like a hard fixed ridge of the size of a lead pencil, extending from the meatus back nearly to the base of the bladder. The orifice was retracted, its edges hard, irregular, nodular, and ridge-like. The vaginal surfaces were normal in color; the surfaces of the urethral mucous membrane were reddish but not ulcerating. There was no involvement of the cervix or uterus; the vagina and vestibule showing only senile changes, except close to the urethral canal. There was no tumor. A No. 6 *ureteral* catheter was passed with some difficulty. It was tied in and the bladder thus gradually drained. In the first 24 hours, 173 ounces or nearly 11 pints of urine were thus obtained and some was lost.

Bladder drainage and rest in bed caused sufficient subsidence of swelling to enable a No. 12 soft catheter to be passed after some days, but retention persisted.

Surgery was inadvisable as the removal of the entire urethra up to the neck of the bladder would have been necessary, with resulting incontinence. Radium was therefore advised. Dr. William S. Newcomet carried out this portion of the treatment, while the bladder paralysis and cystitis resulting from overdistention were being treated in the writer's service at the Presbyterian Hospital.

The patient was transported to and fro, from time to time, to the Department for Radiotherapy of the Jefferson Hospital where an applicator of proper size and efficiency was to be found. Between December 14, 1915 and January 4, 1916, nine applications in all were made, of three

[1] Tr. Am. Surg. Ass., 1908, p. 592.
[2] Cyclopedia of Obstetrics and Gynecology, x, 53.
[3] Fortschr. a. d. Geb. d. Roentgenstrahlen, Hamb., 1914, xxii, 277.
[4] Rev. prat. d. mal. d. org. genito-urin., 1914, xi, 86.

hours each. The quantity used was 20 milligrams of radium element.

The first few drops of urine were spontaneously passed December 24. The quantity gradually increased until by January 15 the bladder was completely emptied by the patient in a normal manner. There was no leakage, no pain, and no bleeding. A No. 19 flexible catheter could now be passed.

The urethra still retained its pencil-like feel. There was a short split in the lower portion of the meatus, doubtless due to traumatism of the rigid tissue. The radium produced a pallor of the mucous membrane both about the urethra and in the vaginal entrance, a form of radium burn, but there had been no loss of substance or ulceration.

The photograph was taken after the radium was used.

A small piece was afterward removed at the edge of the meatus and examined in the laboratory of the Presbyterian Hospital by Dr. Damon B. Pfeiffer, pathologist.

Microscopical report: Squamous celled carcinoma.

The Wassermann test for syphilis was negative, and there was no specific history.

The inguinal lymphatics were not enlarged but when their removal was advocated, the patient disappeared, considering herself well.

Fig. 1. Primary carcinoma of urethra.

INFOLDING AND PERITONEALIZING STITCH WITH APPLICATION OF THE SAME TO BROAD LIGAMENT AND GALL-BLADDER

By HARRY A. SHAW, M.D., Seattle, Washington

In reference to the article by Dr. Williams of Lebanon, Indiana, entitled "A Zigzag Purse-String Suture for Gall-Bladder Work," printed in the January, 1916, issue of Surgery, Gynecology and Obstetrics, and realizing fully the credit due Dr. Williams, by right of prior publication, I desire to point out certain fundamental errors in the said technique and to submit a technique evolved by myself and proved both clinically and upon the cadaver.

The technique submitted is simply an adaption of what I call an *infolding and peritonealizing stitch*, one which has been successfully used upon broad ligament, mesosalpinx and meso-appendix, for more than five years, originally by myself, but in the last few years by a number of local surgeons.

The technique as published by Dr. Williams is impractical for the following reasons:

1. Zigzagging every stitch so frequently angulates the suture that it is almost impossible to draw the same through the tissue and it absolutely prevents symmetrically tight puckering around the drain.

2. The bite in the upper series of sutures is proportionately too short to produce a complete or smooth inversion, as inverting traction is produced by this line of sutures.

3. The added number of sutures coming out on the lower line serve no useful purpose, are time-consuming, and complicating, although they look logical in pictures.

4. There has been no provision made for anchoring the tube.

TECHNIQUE OF CHOLECYSTOSTOMY

The technique which I use in cholecystostomy is illustrated by Diagram 1, a description of which follows:

It is important to make a straight clean cut in the fundus of the gall-bladder (Diagram I, Fig. 1). The suture, preferably No. 1 hard tanned gut, mounted on Dulox needle, enters at *X* (Diagram 1) passing through all the coats about three-eighths of an inch from the cut edge. It is then passed from within out about one-eighth of an inch from the cut edge, at the point marked *O*.

It is next passed from without in at the point marked *I* about one-quarter of an inch from the original point of emergence, i.e., *O*. The suture is carried in and out about one-eighth of an inch from the cut margin, making the bite about one-quarter of an inch on the serous side and one-eighth of an inch on the mucous side, until it passes in at the point of emergence, i.e., *O;* here it dips down and emerges at X^2, leaving a loop of gut about five inches long. This same procedure is then exactly duplicated on the other side, using the same needle and suture.

Figure II illustrates how traction in opposite directions upon *A* by the operator and upon *B* by the assistant produces an inversion of the cut edge. Occasionally there is not a perfect inversion of the central part of the cut edge, this being immediately corrected when the drain is inserted by a slight downward pressure upon the drain,

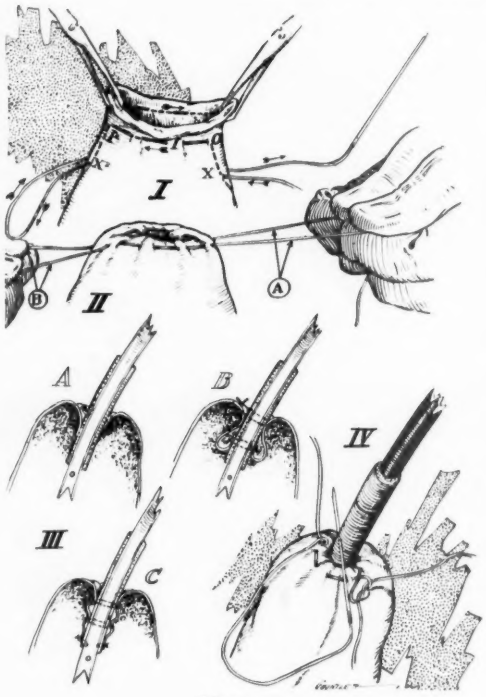

Diagram 1.

just before the sutures are pulled snug for the stay knot, as illustrated in Fig. IV.

Figure III, *A* is a sectional view of above method illustrating the small amount of gall-bladder consumed. *B* shows the method advocated by J. B. Murphy in a recent issue of *Murphy's Clinics*. Note the amount of gall-bladder consumed by this method, as well as the dead space, either real or potential, between the two suture lines. *C* illustrates the method in common use, i.e. two lines of sutures and drain tacked by two tacking sutures to the cut edge, for the purpose of inversion. This is both tissue- and time-consuming.

After the tube is inserted (Fig. IV), the ends (*A* and *B*, Fig. II) are tied (surgeon's knot) *A* by the surgeon, *B* by the assistant. These are drawn snug simultaneously from each side, so as to insure even puckering around the tube. The drain is then tacked in place, utilizing the long suture ends for this purpose.

The advantages of the above technique are:

1. The conservation of tissue. In cholecystostomy we are endeavoring to preserve the gall-bladder and restore its function (compare Fig. III, *A*, *B*, *C*). By this method we certainly do not greatly diminish the capacity of the gall-bladder.

2. There is no dead space (Fig. III, *B*).

3. It produces perfect inversion in a simple, rapid, and efficient manner.

4. It renders easy the accurate insertion of the drain to just the correct depth. The tack suture in the drain serves the double purpose of fixing it *in situ* and assisting in preventing eversion of the cut edge.

5. By cutting loop (Fig. II, *B*) and pulling and tying from both directions, it produces smoother and easier traction and a more symmetrical and tighter purse-string around drain.

Some operators may hesitate to trust one single strand of gut. I personally believe that such fears are groundless and believe that any gut that will stand sufficient strain to properly and tightly purse-string the viscus around the drain, will certainly remain *in situ* 48 hours, after which time union of the infolded serosa would render any accident to the suture harmless. However, if the operator so desires, a seromuscular purse-string can be quickly passed through the infolded walls, around the margin close to the tube, thereby insuring inversion and a snug fit (with practically no waste of tissue), should the original suture break.

I wish to condemn a practice, not at all unusual, i.e., the suturing of the drain to the abdominal wall. This is bad for the following reasons:

1. It does not allow for the natural mobility of the liver which assumes a somewhat different position, according to posture.

2. The liver, to a certain extent, participates in the respiratory excursion. Therefore, it is unwise to fix the drain to the moving parts, i.e., abdominal wall and liver.

3. The abdominal stitch is applied after the wound is closed and is almost sure to draw the gall-bladder upward or force it down into an untoward position.

APPLICATION OF INFOLDING AND PERITONEALIZATION STITCH TO THE BROAD LIGAMENT

As previously stated, the stitch used on the gall-bladder in cholecystostomy was suggested by the "infolding and peritonealizing stitch" which I devised and used for a number of years, upon the broad ligament, mesosalpinx, mesoappendix, etc. This would perhaps be an opportune time to show the application of the stitch in the technique of salpingo-oophorectomy, which I have used with satisfactory results in several hundred cases over a period of five years. The use of the stitch in this particular operation will give a practical idea of its utility and its application during the course of other

NOTE—It may occur to the reader that chromic gut No. I may not permit the removal of the tube at the earliest interval desired. A slight rotation of same, back and forth, will easily free it after five or six days.

surgical procedures. This will be apparent to all that glance at the following illustrations and the accompanying legends (Diagram 2).

TECHNIC OF SALPINGO-OOPHORECTOMY

To (*a*) bloodlessly remove our mass, (*b*) close the gaping defect in the broad ligament, and (*c*) peritonealize our denuded areas, are the special indications in salpingo-oophorectomy, all of which is accomplished with rapidity in the following manner. After proper exposure and exploration, packing-off field, freeing mass, etc., we proceed, as shown in the following anatomico-schematic illustration. (These illustrations are purely schematic, thus illustrating the mechanics of the technique more efficiently than similar ones correct in anatomical detail.)

Diagram 2, Fig. I shows the clamp applied along the broad ligament, directly beneath the mass. The sutures first passing through the broad ligament at *I* and back at *O*, about one-eighth of an inch from clamp, are then brought through again at I^2 and back out at O^2; in again at I^3, etc., as per illustration. Usually three complete suture units are just right; however, occasionally two will suffice. *A* Ligature around the edge of the infundibulopelvic ligament, thereby securing individual ligation of ovarian artery. *B* individual ligation of the ascending branch of the uterine artery. *C* suture passed through the cornu, just above and back, just below the tubo-uterine junction. This to be tied immediately upon excision of the tube (See Fig. II).

Figure II shows the mass, including the proximal tube, excised and *C* ready for tying.

Figure III shows the mass removed. In removing the mass we use scalpel and direct blade toward the clamp to avoid the danger of cutting the suture.

Figure IV illustrates how traction in the opposite direction upon each suture end draws the two separated layers of the broad ligament together and infolds the ragged edge.

Figure V shows the infolded edges being pleated into position and held there by tying suture, thereby closing the gaping defect in the broad ligament and restoring the normal anatomic support to the uterus.

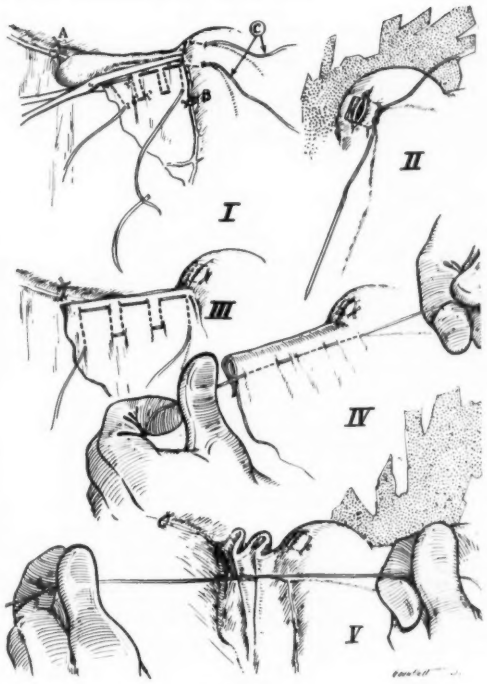

Diagram 2.

A NEW OPERATION FOR THE TREATMENT OF VARICOCELE

By Dr. DELFOR DEL VALLE, Buenos Aires, Argentine
Chief of the University Clinic; Surgeon, Ramos Mejia Hospital

SINCE the primitive operation of Curling up to the time of Stonum of Krakau, there have appeared a series of operations for the treatment of varicocele which have been based on the cremaster, the veins, the scrotum, and finally on the tunicavaginalis or aponeurotic plastics. These operations have been described by Celso, Pablo de Eguir, Cooper, Petit, Bonorno, Osborn, Cartu, Vince, Mori, Meaise, Narath, Ricord, Vidal de Casis, Richard Barwell, Pegaud, M. Jeune, Bonet, de Vallet, Nelaton, Richet, Gould, Beonard, Breschet, Debonil, Y. Y. Petit, Freund, Nandonzi, Samson, Guyon, Berningtree, Gunnar, Moriguet, Jacobsen, Parona, Posadas, Goniour and Totonium.

Goniour of Bucharest, while recommending his procedure, rightly says that the operations based on resection of the scrotum are innocuous and those which alter the veins are noxious. I hold a similar opinion as to these operations because clinical experience proves that resection of the scrotum is generally followed by recurrence and that extirpation of the anterior venous group produces dystrophia of the testicle and chronic congestions. These symptoms are chiefly due to the suppression of the spermatic artery which is the most important artery entering the gland. The experiments of Charles Esmonet on dogs and rabbits prove these facts by showing that the epithelium cells of the gland degenerate and the glycogene and fat disappear.

This plainly shows that complete extirpation is dangerous. The technique perfected in Dr. Decoud's clinic overcomes these difficulties by preserving the spermatic artery and the veins of the cord. Therefore besides being preservative, the operation diminishes the congestion of the veins by alternate ligatures and suspends the testicle at a convenient height, thus correcting the ptosis. I have personally treated over 60 cases by this process and have followed 20 of them closely, two, three and four years after the operation. In only one case a complete cure was not obtained, due undoubtedly to a technical error during the operation. The results so far are very satisfactory; as good, if not better, than those attained through any of the other methods. Œdema and pain in the cord and testicle so frequently noted after these operations, were not observed.

The photographs accompanying this article, taken before and after the operation show the favorable modifications of the scrotum and the new position of the testicle in some of the most typical cases.

STEPS OF THE OPERATION

First step. Palpate the external abdominal ring and make an incision over it, from five to six centimeters long, passing through the skin, the superficial and intercolumnar fasciæ. Separate the edges of the incision with Farabeuf's retractors, thus displaying the external abdominal ring, with the cord passing out between the internal and external pillars (Fig. 1).

Second step. Carefully incise the infundibuliform fasciæ so as to expose the parts of the cord and vas deferens, the veins, artery, etc., which are retracted outward, then dissect the veins, from the external abdominal ring to the testicle, from the other parts of the cord. Usually five or six veins can be found greatly increased in size, with varicose dilatations, and anastomosing one with the other by similarly affected collaterals (Fig. 2).

Third step. The group of veins is now lifted forward from the wound by the assistant who holds each extremity between the finger and thumb of each hand, maintaining this position throughout the next step of the operation, the object being to avoid any rotation of the veins. The operator carefully separates the veins into two groups, an anterior and a posterior (Fig. 3).

Fourth step. A catgut ligature is now passed and tied around the posterior group, one finger's breadth above the upper limit of the testicle. Another ligature (silk) is similarly applied to the anterior group but two fingers' breadth above the level of the catgut suture and left long. It is advisable to follow the above details carefully as upon their exact performance, especially the measurements, as the amount of circulation left to the testicle depends entirely on the level at which the upper ligature (silk) is placed. In this way, the cord can be shortened by some four to five centimeters (Fig. 4).

Fifth step. One finger's breadth internal and parallel to the fibers of the internal pillar of the ring, make an incision four centimeters long through the fasciæ. Pass a Kocher's forceps

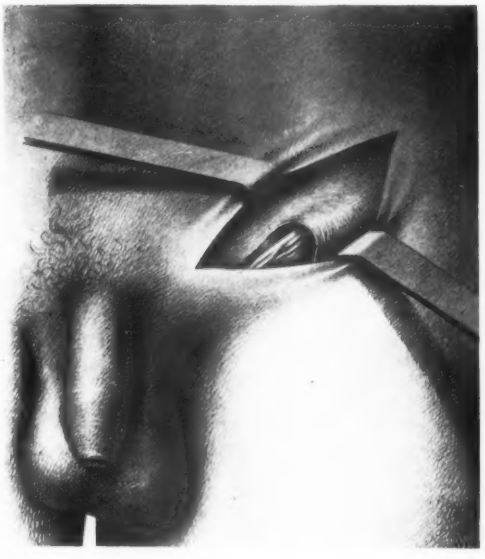

Fig. 1. First step of operation.

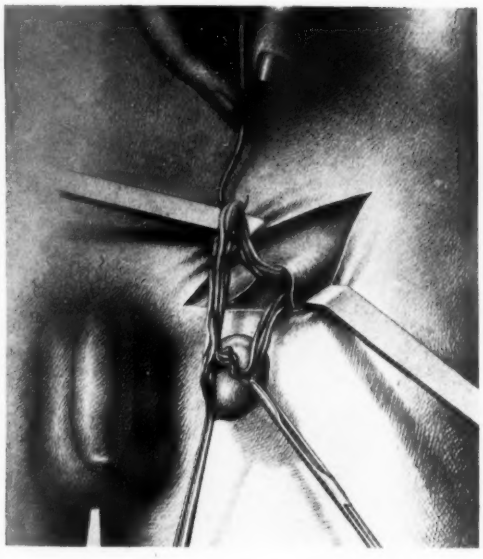

Fig. 2. Second step of operation.

through this incision and the subjacent conjoined tendon, making it come out through the ring. Pick up the ends of the silk ligature in the forceps and pull them through, thus making the anterior group of veins pass through the opening in the fascia and raising the testicle (Fig. 5).

Sixth step. Having carefully fixed the level at which it is desired to leave the testicle, the end of the silk ligature with a needle is passed through the fascia of the external oblique and tied. The operation is finished by suturing the edges of the incision in the fascia together behind the loop of the veins, thus leaving each end of the incision open for the veins to pass through (Fig. 6).

Fig. 3. Third step of operation.

Fig. 4. Fourth step of operation.

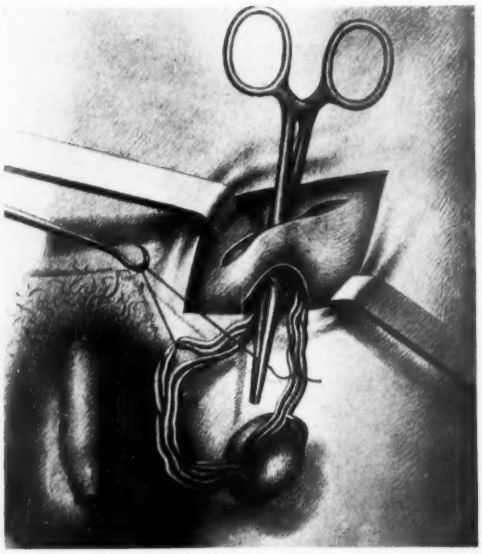

Fig. 5. Fifth step of operation.

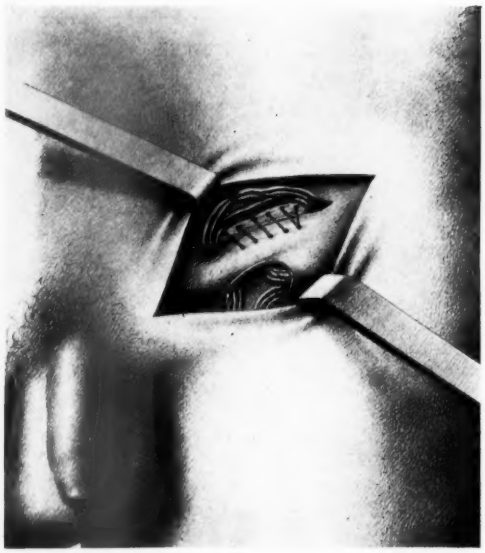

Fig. 6. Sixth step of operation.

It should be stated that if the posterior group of veins is the one affected, the steps of the operation are the same, except that in the fifth step the opening is made in the external pillar of the ring, instead of in the internal.

BASIS OF THE NEW PROCEDURE

As I have already shown the different procedures which have so far been used for the surgical treatment of varicocele, all rest on a pathogenic and symptomatic basis. The procedure now proposed rests on a similar basis, but while it observes closely all the factors which justify the operative treatment of varicocele it is superior to them all in being the most conservative.

The principles of the operation may be divided into three groups: (1) anatomical, (2) physiological, and (3) pathological.

Anatomical. The veins of the cord form two groups with relation to the vas deferens. Some anatomists recognize three, but the so-called third group, viz., the lateral, in practice belongs to the anterior group. This group (the anterior) is made up of five or six veins, which anastomose freely with each other, two or three centimeters below the ring, so that while they reach the testicle, they form a true plexus.

The spermatic artery, the principal artery of the testicle, is found in this group. The posterior group is formed in the same way and contains the deferential and funicular arteries, both smaller than the spermatic and not so important in the nutrition of the testicle. Now when the principal trunks are interrupted alternately and at different levels by an anastomosis, the blood current is forced through the anastomosed collaterals and largely suppressed in the principal trunks themselves (Fig. 7).

Let A, B, C, and D represent the four principal veins coming from the testicle with their anastomosis branches, a, b, c, d, e, f, g, h, i, j, l, m, n, o. A ligature is applied to C and D at S, and another to A and B at S'. The blood flows in C and D, being obstructed at S, passed by the collaterals o and n, arrives at A and B by an angular route. Similarly the blood in A and B is obstructed at S', and has to pass by d and e and so finds its way to C and D.

This scheme rests upon the following fundamental principle: The blood in any of the large venous systems (vena cava) obeys the same hydraulic laws as does the liquid circulating in any system of tubes which communicate with each other. Applying this principle to the spermatic veins we get *1* in Fig. 7; four or five parallel tubes of a known diameter coming from the testicle and united among themselves by the collaterals which form angles with them. In this system each second, a more or less constant quantity of blood passes which we shall call two units.

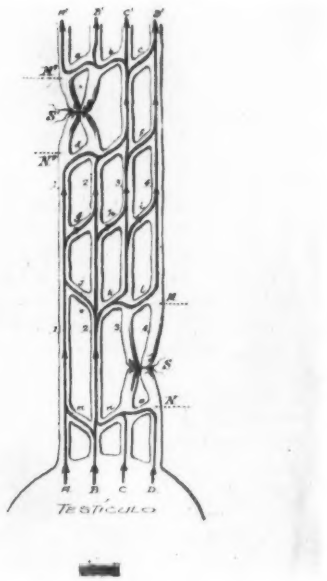

Fig. 7. Diagram showing venous distribution in the testicle.

Fig. 8. Diagram showing I testicle; II vas deferens; III spermatic artery; IV ligature of veins, anterior subgroups; V ligature of veins, posterior subgroup; VI veins of anterior group; IX veins of posterior group.

When the veins become varicose, the quantity of blood which passes per second is increased to four or five times the normal, or from two to eight or ten units.

This can be observed clinically, by comparing the veins of the affected side with those of the sound one, when it can be both seen and felt that

Fig. 9. Man 22 years old, before operation.

Fig. 10. Same as Fig. 9.

Fig. 11. Same as Fig. 9 after operation.

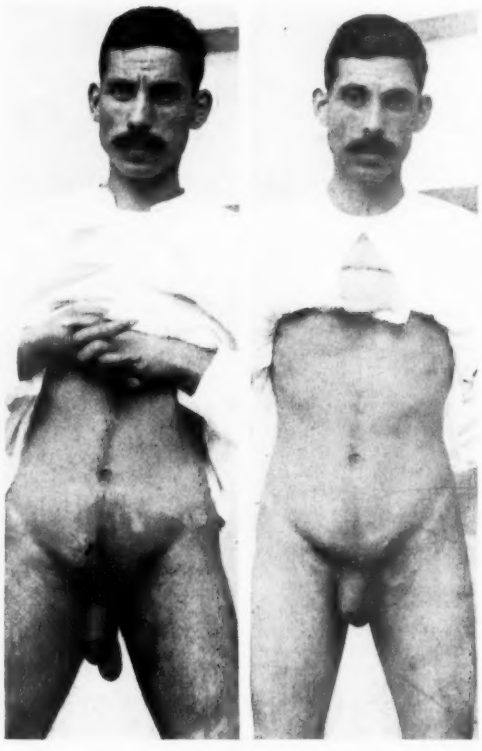

Fig. 12. Man of 28, before operation (at left); after operation (at right).

the affected veins are four or five times more bulky than the healthy ones.

If in this system we place two obstacles S and S' we get conditions similar to those enumerated in the hydraulic law: If in a system of parallel collecting tubes which are united among themselves by tortuous tubes of smaller caliber, obstacles are so placed that the liquid has to pass by the connecting tubes, the current will be reduced and the discharge in a given time will be less than when the obstacles did not exist. Applying this principle to the anterior group of veins—steps 3 and 4 of the operation—we obtain (1) a notable diminution of the stream and consequently to a certain extent a decrease in the amount of stasis, thereby alleviating the symptoms of atrophy and dropping of the testicle and neuralgia of the cord, all of which are aggravated by the upward posture. (2) As the spermatic circulation is only interrupted alternately and at different levels in its two branches, the total flow is not diminished owing to the anastomosis (Fig. 8).

PATHOLOGICAL ANATOMY

The very complete study of the pathological anatomy made by Cornil shows that the varicose dilatations affect the large trunks chiefly and the collaterals secondarily and both acquire proportions much greater than the normal caliber.

In an uninjected corpse, the dissection of the veins, especially of the collaterals, is a matter of extreme difficulty. In the living subject, it is easier and easiest of all when a varicocele exists, due to the greater size of the collateral branches, which are of the size of the normal trunk veins, these in turn being as big as the cephalic or basilic vein. This increase in size of the anatomical parts renders the ligature of the veins as described in the third and fourth steps of the operation, a matter of relative simplicity.

Histologically a chronic mesophlebitis is the chief noticeable change. This produces a great thickening of the venous walls and they are rendered rigid so that the group of veins forms an excellent and solid cord by which to maintain the testicle well braced up (sixth step). Though based on the same principle as the operation of Longuet a further advantage of this procedure is that the fate of the testicle is not compromised by an excess of veins as in his (Longuet) operation.

As Poirier has pointed out, the varicocele is cone-shaped, the base of the cone below corresponding to the testicle and the apex at the external ring. This is due to the fact that in the canal the veins are supported by the walls of the inguinal canal and so only become varicose lower down where support is absent or lacking. Narath's operation is based on this observation; he proposed to ligate the veins in the inguinal canal, but as Poirier shows, this is simply to suppress the functions of the veins *en masse*. In my operation the veins are placed in such a position that they receive the maximum support from the constant pressure of the surrounding tissues, and this tends to add tone to the walls and prevents any further dilatation, since they lie between the external oblique in front and the internal oblique and conjoined tendon behind.

Instead of complete ligature which Narath practiced and which entirely suppresses the veins, my operation, by reason of the aponeurotic bridge which the suture of the incision of the external oblique forms (sixth step), produces an obstruction to the circulation each time the muscle contracts, forming in this way a kind of living ligature, which is most active when the patient moves about on his feet; in other words the effect is

produced exactly at the moment when most needed.

SUMMARY

The proposed technique is undeniably superior to any other method applied up to the present day, for the following reasons:

1. The technique is simple.
2. The operation diminishes but does not suppress the function of the affected venous group.
3. The circulation of the spermatic artery is not suppressed.
4. The testicle is suspended by the same group of veins that are extirpated in the other procedures.
5. The greater part of the veins placed between the muscles of the abdomen suffer a constant elastic pressure which tends to diminish their aneurismal tendency.
6. The testicle is furnished with a living suspender.
7. Although it diminishes the venous conjestion and raises the testicle just as do the other radical methods, it is essentially conservative.

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TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JANUARY 21, 1916, WITH THE PRESIDENT, DR. CHANNING W. BARRETT, IN THE CHAIR

A GIANT PYOSALPINX

DR. MERRILL WELLS (by invitation) exhibited a specimen of large pyosalpinx, and in connection with the same made the following remarks:

Chronic pyosalpinx is not at all uncommon; it is a condition met almost daily in hospital practice in gynecology. In the extensive literature on the subject there is frequent mention of the formation of large tumor-masses as the affected tubes increase in size during and after the stage of active pus-formation. Usually in the descriptions of these tumors comparisons are made as to size and weight, but as a rule accurate dimensions are seldom noted. Thus it is difficult indeed to give credit where it is due for reports of the largest or most unusual tumors formed in chronic pyosalpingitis.

In reporting the case in which this specimen was removed, no attempt is made to put it on record for its size alone. However, we have considered it sufficiently interesting from both clinical and pathological viewpoints to warrant this brief mention.

CASE 87,066. The patient, Mrs. L. A. B., a white woman, aged 37 years, was admitted to the Presbyterian Hospital June 9, 1915, in the service of Dr. J. Clarence Webster. The following history and physical findings were obtained:

Complaint. (1) Tumor-mass in the right lower portion of the abdomen. (2) Pain in the left lumbar region. (3) Headache. (4) Loss in appetite and weight.

History of complaint. (1) Failing health with general indisposition was noted some months ago. Upon examination the patient's physician found a mass in the abdomen, and since that time the patient has been able to note its presence. She thinks that it has increased in size during the past few weeks. (2) Pain in the left lumbar region has been noted at intervals for the past three years. It is of a sharp, sticking type, but does not radiate in any particular direction. It is not particularly aggravated by the patients routine life. (3) Headache over the frontal and parietal regions has been noted for some months; no definite time of onset was noted. It is not associated with nausea or vomiting. (4) The appetite began to fail about four or five weeks ago. Her usual weight is 130 pounds; present weight 122. There is little or no distress from food.

Menstrual. Flow began at 11 years. Regular 24-day type. Flow lasts 2 to 3 days; no pain at periods. Last period began June 1, 1915.

Marital. Married twenty years; pregnant once with induced abortion at third month three years ago.

Medical. Measles, mumps, and scarlet fever in childhood. Patient is occasionally jaundiced. No other distress. *Surgical.* Negative except for the above-noted induced abortion.

Family. Parents dead; brother and sister alive and well. No chronic family disease. *Habits.* Appetite poor; bowels constipated; urination normal; uses tea, coffee, and alcohol in moderation.

Physical examination. A fairly well-nourished young woman whose color is sallow. Sclera show subicteric tint. Head and neck otherwise negative.

Chest. Lungs and heart negative. *Abdomen.* There is a visible prominence in the lower abdomen, most marked on the right side. No tenderness or rigidity in the abdominal wall. On palpation, a three-lobed elastic tumor-mass is outlined. There are no vessel sounds over it and no pulsation noted. Liver and spleen are not palpable. Extremities are negative. Reflexes, normal.

Vaginal examination. Introitus admits three fingers; cervix smooth and high in the vaginal vault; uterus with appendages apparently twisted slightly to the right; palpable tumor-mass in the right fornix, moves with motion of tumor with left hand on abdominal wall.

Blood. Leucocytes, 5,700; hæmoglobin, 70 per cent, Dare; blood-pressure, systolic, 118, diastolic, 80.

Urine. Negative except for a few epithelial cells and polymorphonuclear leucocytes.

Temperature. On admission, 98° F.; pulse, 80.

At operation June 10, 1915, laparotomy was made in the median line. Abdominal findings were as follows: Left tube is huge, about 30 by 10 by 10 cm., is twisted twice on its ligament attachment and lies in the right side of the abdomen and pelvis. Two loops of ileum are adherent to it. The right tube is indurated; right ovary cystically degenerated. Several gall-stones are present in the gall-bladder; two small ones in the cystic duct. The right kidney is normal; left kidney small and thin. A nodular, hard mass about the size of a man's fist is palpable in the mesocolon at the sigmoid flexure, with indurated glands round about. (Clinically carcinoma.) The appendix is thick and bound in adhesions.

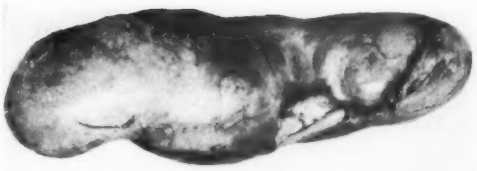

Fig. 1. A giant pyosalpinx, 30 cm. long, 8 cm. average diameter, weight 1,540 gms.

Operative procedure consisted in removal of the left tube and ovary, the right tube, and the appendix and igni-drainage of the right ovary.

The patient made an uneventful recovery from operation and left the hospital on the seventeenth day. Her relatives were told, however, of the presence of probable malignant growth at the sigmoid flexure of the colon and the prognosis was shaped accordingly. About one month later report of the patient's condition was obtained through the kindness of her family physician, Dr. MacMartin. At that time there were physical signs of a small collection of fluid in the abdominal cavity and a marked general weakness. The patient died after apparent symptoms of malignant disease late in September, 1915.

The pathological report on the specimen removed at operation is as follows: The tumor is sausage shaped, 30 cm. long, 11 cm. greatest diameter, 8 cm. average diameter, 6 cm. minimum diameter. It weighs 1,540 gms. Its surface is smooth and glistening except for two abrasions and an area of attachment 4 cm. long at which point the tumor was severed. There are numerous tortuous, purplish blood-vessels immediately beneath the surface and plainly visible. There are several small roughened areas, sites of previous adhesions separated in the removal of the tumor. On palpation the tumor is elastic, with slightly less firm areas at several points in its extent. Adjacent to the point of attachment lies an ovary embedded in parametrial tissue. It is 5 by 3 by 2 cm. in dimensions and is cystic at the proximal pole and on its posterior surface, and markedly sclerotic on its anterior surface. There is a band of adhesions 15 cm. long extending from the posterior lower aspect of the ovary to a point 8 cm. from the lower pole of the tumor.

No free pus was obtained on aspiration of the firm tumor mass. It was hardened *en masse*. Later microscopic sections were made from several blocks of tissue. These showed chronic inflammatory changes in the tubal tissue with some fibrosis of the muscular coat. Special search for evidences of malignancy and tuberculosis revealed nothing.

In closing it may be of interest to mention one fact in connection with the clinical diagnosis of the case which was recalled at the time of operation by Dr. MacMartin. In 1905, ten years ago, the patient was seen by Dr. Webster because of complaint of slight pelvic pain. She was told at that time by him that one tube was twisted and swollen and was advised to have it removed. She disregarded this advice and had no marked discomfort until the present history begins, but the diagnosis was amply confirmed at operation.

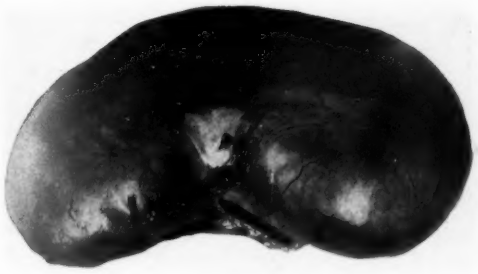

Fig. 2. Pus tube weighing 19¾ pounds.

I am indebted to Dr. Webster for the opportunity to present this case.

UNUSUALLY LARGE PYOSALPINX

Dr. Daniel Hale Williams and Mr. Kenneth Hallock (by invitation) exhibited a specimen of huge pyosalpinx.

The patient from whom this rare and unusually large specimen was removed is Mrs. H., aged 36. She menstruated at 16, and continued to menstruate regularly until she was about 27 years of age. From that time up to about three years before she was operated upon the menstrual period would last from six to seven days, with considerable increase in the quantity of the flow. So far as I can ascertain she has never been pregnant, and she has no recollection of ever having had a vaginal, uterine, or pelvic infection. This reference is important because it may have some bearing on the question of primary infection which is discussed in the pathological report of the case by Mr. Hallock.

Of the four blood examinations that were made, none of the laboratory reports show any marked reaction. The leucocyte count varied little from 7,000 during the time of the patient's stay in the hospital. This is not an uncommon feature in old pus cases.

The urine furnished an index of what followed. She came to the hospital with an albumin showing of 20, specific gravity, 1,008; there were no casts. Amount voided in 24 hours varied from 13 ccm. to 16 ccm. Notwithstanding the condition of her urine, it was not accepted as a contra-indication against operation, for the patient stood the operation well and made a perfect recovery.

Further investigation led me to the conclusion that important amyloid changes were taking place, which were undoubtedly due to the long-continued absorption of septic products from the extensive pus tube.

I first saw and examined this woman more than six years ago, at which time I found that the solid tumor had grown well downward into the cervix, and latterly extended to the limitations of the small pelvis, but it was not impacted. The patient suffered much pain at times in both lower extremities due to the pressure of the tumor on nerve-trunks. The soft associated mass could be palpated above the pubis. Operation at this time was advised, but was refused. Three years later I examined the patient again and found that this solid tumor was well out of the pelvis and was extending into both flanks. The soft part of the growth had extended quite as high as the umbilicus. Three years later, when she came for operation, the growth had attained a sufficient size to fill the entire abdomen, causing great embarrassment to respiration. The solid fibroid tumor was clearly defined and satisfactorily understood by combined palpation. The fluctuating accessory mass was not well defined or understood, and it was thought by those practitioners who examined her that as the fluctuating mass was very closely associated with the well-known fibroid, it was a fibrocystic growth.

At the operation a long median incision was made to determine the boundaries and ramifications of the growths. A hand-syringe aspiration was made and a specimen withdrawn and sent to the bacteriological laboratory for examination. After examining the specimen Dr. Moody reported that it was pus. On the strength of this information it was decided that the case was one of suppurating cyst.

The entire growth was removed and sent to Dr. LeCount's laboratory for examination and diagnosis. Three days' later I was informed by Dr. LeCount that what we had supposed was a suppurating cyst was really a pus tube, and he added, "that perhaps none so large had ever been noted."

A diligent and thorough search of the medical libraries of Chicago and that of the Surgeon-General's Office at Washington, discloses no report of a pus tube of quite one-half the size of the one herewith recorded.

I am deeply indebted to Dr. E. R. LeCount for his recognition and diagnosis of this very rare specimen; also to Dr. H. M. Moody, resident pathologist in St. Luke's Hospital, for the bacteriological work, and to Mr. Kenneth Hallock for the preparation of the specimen and for the following pathological report:

The specimen weighed at the time of operation 19¾ pounds; it was 17.5 inches in length, and 22.75 inches in circumference at its largest diameter. It was filled with a yellow caseous material of the consistency of thick cream; on bacteriological examination, this was negative, for both aerobic and anaerobic organisms.

The external surface is smooth and shining, and well supplied with blood-vessels, deeply injected, which radiate outward from the central point of the concave side. At this point the two peritoneal folds composing the broad ligament are seen, and between them the ovary, of approximately normal size, completely surrounded by its capsule and containing a large blood-clot and a corpus albicans.

It was not considered advisable to destroy the value of the specimen by cutting into it, in order to make microscopic sections, but we have no doubt that the specimen is a fallopian tube, since: (1) It was attached to the right cornu of the uterus, lying lateral and posterior to the uterus, corresponding in position to the left tube. (2) We find the complete ovary surrounded by its capsule, lying in the folds of the broad ligament. (3) In shape, it is elongated and curved, differing in this respect from ovarian and tubo-ovarian cysts, which tend to have a spherical outline.

A search through the available French, German, and English literature failed to reveal any report of a tube approaching this one in size.

It was suggested to the writer that the negative bacteriological findings, and the lack of inflammatory adhesions would suggest rather a cystic condition of the tube. We were able to find in a brief search through the literature, three hundred and two cases of undoubted pyosalpinx which were negative for the common pyogenic organisms, as follows:

Menge	25 cases
Morax	32 cases
Schauta	140 cases
Wertheim	72 cases
Kelly	33 cases

DISCUSSION

DR. HEANEY: What does the histological examination of the opposite tube show?

MR. HALLOCK: There was none made. Histological examination would not reveal anything because the probabilities were there would be no tubal epithelium left after this time, and Dr. LeCount did not want to destroy the value of the specimen by cutting into it for microscopic work.

PYELITIS OF PREGNANCY WITH ESPECIAL REFERENCE TO ITS ETIOLOGY

DR. W. C. DANFORTH presented an inaugural thesis entitled "Pyelitis of Pregnancy With Especial Reference to Its Etiology" (see p. 723).

DISCUSSION

DR. CHARLES B. REED: I think this paper of Dr. Danforth's is a very timely one. It is a subject which has been interesting to obstetricians particularly for a number of years and has only recently been studied as it should have been. Dr. Danforth has covered all the points very systematically and thoroughly. There is one part of his paper, however, that I think needs a little more emphasis, and that is in regard to the treatment. The treatment is still under discussion. In my own experience I have seen a number of these cases which were operated upon by surgeons of repute and the women aborted,

and it has seemed to me that in nearly every case where the kidney has been interfered with, abortion has resulted. In consequence of this experience I feel that if the case has progressed to such an extent that interference with the kidney is demanded, abortion should be produced first. The woman should first have the uterus emptied, and if the condition does not clear up, a subsequent kidney operation can be done. As a matter of fact, most of these cases clear up under treatment spontaneously in about two weeks. I believe they are self-limited, but there are cases that do require emptying of the uterus primarily and the kidney operation secondarily, rather than the reverse.

Dr. Theodore J. Doederlin: Of the few cases I have had of this type of disease, there is one in particular which I reported in the *Journal of the American Medical Association* several years ago. As I remember the case, it was strictly a self-limited disease, lasting about three months. I had the patient in the hospital for three months prior to delivery. The patient was very ill with chills, fever and sweats, the temperature going up to 104 or 105° F. There were pure cultures of colon bacilli in the urine, but directly after delivery the urine was normal. I examined the woman two or three months afterward and found the urine normal. This led me to believe that the source of trouble was not an ascending infection but rather a blood infection which localized itself—in short, a *locus minoris resistentiæ*. This case was very interesting to me because the woman was so sick before delivery and so well after treatment. I think operative interference, as recommended, is unnecessary, as Dr. Reed has suggested. It is a distinctly self-limited disease.

Dr. N. Sproat Heaney: The point I wish to discuss is whether or not pyelitis of pregnancy can be really called self-limited. When the uterus is emptied at full term or prematurely, the patient is, as a rule, promptly rid of her fever, localized pain and all the other symptoms of her pyelitis. Her urine, however, does not clear up entirely and does not tend to clear up without further treatment. In the event that she becomes pregnant again while the urine is still abnormal, she will again have pyelitis—though usually not so severe as in the first attack, since this disease is more acute in primiparæ.

I have now under observation two patients illustrating this fact: One of these patients has had six previous pregnancies, in four of which the diagnosis of pyelitis was made. During one pregnancy a surgeon wished to remove the kidney, but since preliminary abortion produced a symptomatic cure, the nephrectomy was not done. She was aborted one other time because of pyelitis. In the other two attacks she carried the children to term. She is again pregnant and though she has no symptoms of pyelitis, she has pus and colon bacilli in her urine and is in consequence quite liable to have a pyelitis during this pregnancy. This patient has undoubtedly never been entirely free of pus or bacilli during any of her pregnancies and will be subject to recurrences until during an interval we can rid her urine of the colon bacilli.

Another patient now under my attention has had pyelitis in both of her previous pregnancies. In the first she was said to have had an appendicitis in pregnancy and a recurrence in the puerperium; in the second pregnancy the pyelitis was diagnosed. Though only three months pregnant now, her kidney is beginning to cause some pain and the urine shows pus and colon bacilli. Neither of these patients has received thorough treatment after delivery. I have had several patients where the urine was freed of pus and bacilli after their pyelitis, that have gone through second pregnancies without any pyelitis.

Of especial interest in Dr. Danforth's paper is his notice of the confusion between pyelitis and appendicitis in pregnancy. It has never been my experience to see a real case of acute appendicitis in pregnancy—though they, of course, occur—not as often, however, as diagnosed. The symptoms are much alike and I have been called several times where this mistake was made, twice by physicians for their own families. No one should call such an attack an appendix without examining microscopically a catheterized specimen. I have known of several inoffensive appendices being removed under these circumstances where the fever persisted and the diagnoses made only subsequent to operation. Every case should be treated after delivery and a conscientious effort made to rid the urine, not only of pus but of organisms.

Dr. Rudolph W. Holmes: Unfortunately, I was not present while Dr. Danforth was reading his paper, but I would like to present a case report which is appropriate to this discussion of pyelitis. It is really inconceivable that my report can be true, but I can depend on the veracity of those who attended, and watched the patient through her illness.

A woman on New Year's eve had company. During the evening she had a great deal of dysuria, with diarrhœa, which continued for three or four days thereafter. At the end of this time she was constipated for a few days, evacuations being secured by cathartics. From the ninth day to her death her stools were watery. I saw her on the ninth day of her illness at which time she was conscious, and she positively maintained she had not urinated since the last day of the old year. Her attending physician had repeatedly catheterized her, and when he did not do so, a nurse did. At no time was there more urine than would fill the glass catheter and the fluid was purulent. She died on January 16, and during these 16 days she secreted no urine other than that mentioned. She had a large tumor of the upper right quadrant which completely filled it, encroaching about two inches beyond the mid-line, and the same distance below the umbilicus, which was determined to be a pyelitic kidney. She was about seven and a half months pregnant. Her complexion was of a yellowish waxy type. The first consideration was to termin-

ate the pregnancy and, accordingly, under a light ether narcosis the os was manually dilated (it already admitting two fingers), the head was crowded deeply into the pelvis and low forceps were applied. From the beginning of the operation to the completion of delivery only eleven minutes elapsed. I was in hopes of doing a cystoscopic and ureteral catheterization in a day or two after but such was not permitted me. She was opened in the left flank by others in the hopes that a decapsulation of the left kidney might relieve a possible left compression and reflex stasis, but no kidney was found. However, on the twelfth day, on going in on the right side, a tumor was found which was so large and looked so forbidding the surgeon did nothing.

I cannot reconcile myself to the fact that a woman could go sixteen days without any urinary secretion and above all things that she could remain conscious during the same period. It might have been that there was an uretero-intestinal fistula which caused the later watery stools, but this is a mere conjecture.

Of course, pyelitis is a matter of degree: formerly only the fulminating cases were recognized. Now we know that many a so-called cystitis is actually a pyelitis with bladder symptoms as the preponderating signs of disease, the purulent urine from the kidney keeping the bladder infected and irritable.

For mild cases of pyelitis, conservative procedures should be the rule; in aggravated types, irrespective of the duration of pregnancy, I believe the emptying of the uterus has a beneficial effect on the disease, and often should be elected.

Some months ago I saw a woman two or three months advanced in pregnancy who had had a fulminating attack of pyelitis in a previous pregnancy. I was the fourth or fifth physician to see her. Two were genito-urinary surgeons and one at least wanted to removed the kidney, although there was not a sign of trouble then present; the other desired that the uterus should be emptied. The only suspicious sign was the fact that centrifuging a twenty-four hour specimen a few colon bacilli were thrown down. Under the advice of expectancy she passed through the pregnancy without any disturbance whatsoever. Certainly, catheterization and washing of the kidney should be tried before a nephrectomy for pyelitis.

DR. RACHELLE S. YARROS: I had a case that was extremely interesting to me, a few weeks ago, of a woman whom I watched carefully during the fifth month of pregnancy. I had examined her urine twenty-four hours previously, and sent a specimen to the laboratory, which was carefully examined and the report was negative. On Sunday she went to the country and was exposed to cold, although she did not feel cold, and when she came home Sunday morning she noticed a little blood on the sheet. She said to me, "Do you believe I am going to miscarry?" I told her to sit quietly. She did not tell me about the cold in the evening. She did not telephone for me. The next morning more blood came away, but I found it was not blood from the uterus but blood that came from the urine, which she had not noticed before. I had a catheterized specimen of urine, and found it was full of blood-corpuscles. Twenty-four hours later she called me up in the middle of the night and said she had a severe hæmorrhage. We took her to the hospital, catheterized the bladder again, and we found the consistency of the urine was that of blood instead of urine and the next day we had one of the genito-urinary specialists make a cystoscopic examination. He said he had never found such an injected disease of the bladder. He catheterized the ureter on one side and also got turbid urine in which was found the colon bacillus on cultivation as well as a number of red blood-corpuscles. Nitrate of silver was injected, the patient was put to bed, and a dubious prognosis was made. She improved in the first twenty-four hours. The urine improved very much, and after three days was absolutely normal. We have had no other cystoscopic examination made, and there has been no evidence of blood for the last month, and apparently the woman has made a perfect recovery. Of course, blood in the urine is not uncommon in pregnancy—at least, blood-corpuscles; but such hæmorrhage from the bladder I have never seen before. Twenty-four hours before that the urine was normal, and the specialist did not want to say it was due to exposure to cold. He could not explain satisfactorily the extreme condition. He thought of tuberculosis and of other things, but it could not have cleared up in so short a time if there was anything serious. The woman has made a splendid recovery, and I cannot explain the condition on any other ground than that it was due to the exposure to cold. We did not make a bacteriological examination of the previous specimen before the blood appeared.

I should like to know how many cases any of the members have seen of this kind and what their explanation is as to the condition of this woman, since we can find nothing abnormal now.

DR. W. C. DANFORTH (closing): I was hoping someone would go into the bacteriological side of this subject. So far as the treatment of the malady is concerned, I agree fully with what has been said by Dr. Reed and Dr. Holmes. I do not think a radical operation on the kidney is the thing to do unless one is forced to do it by the absolute presence of pyelonephrosis. If the case is seen by a competent man, I do not see any reason for a radical operation. Palliative means, the use of the ureteral catheter, and, if necessary, emptying the uterus, are the things to do.

I have no explanation to give of the case which Dr. Yarros reports unless a bacteriological examination of the urine would afford an explanation.

CONTRIBUTION TO THE STUDY OF TWILIGHT SLEEP

DR. CHARLES B. REED read a paper entitled "Contribution to the Study of 'Twilight Sleep'; A Study of One Hundred Cases" (see p. 656).

DISCUSSION

DR. JOSEPH L. BAER: I have only a few words to say on this subject. In brief, I would refer the members to an article that appeared in the *Journal of the American Medical Association* six or eight months ago, representing a period of two months of observation of scopolamine-morphine analgesia carried out at the Michael Reese Hospital. That series was under the observation of my seniors, Drs. Cary and Frankenthal, and myself. The cases were watched, as such cases should be watched, and the results we obtained were so radically unfavorable as to compel us to abruptly terminate the series.

Most of the things mentioned by the essayist occurred in our series, such as soiling the genitalia, delirium, death, maternal and fœtal, and yet we feel that everyone of the precautions had been taken to avoid such accidents. Our material consisted largely of Russian, Polish, and Jewish women, and as the essayist has pointed out, they are supposedly emotional, and hence supposedly unsuitable for this particular form of treatment. However, Dr. John Osborn Polak, of Brooklyn, when he was here last year and told us how to do this, laid special emphasis on the point that this treatment was well chosen for nervous, high-strung, emotional women. Likewise, among the few remaining enthusiasts for "twilight sleep" in this country, Dr. Rongy of New York has exercised his series of cases entirely on Jewish women in the Beth-Israel and Jewish Maternity Hospitals, and he is, as I say, really an enthusiast. We felt that the risks were real; that the jeopardy of the women was real, and we were unable to select suitable cases by any method we could determine as efficient. If we knew which cases were going to react favorably to the scopolamine-morphine analgesia, we would be delighted to resume the series, because in our series of seventy odd cases, there were about six thoroughly successful analgesias but we do not know how to pick out those in which the treatment will be suitable, and rather than repeat our disastrous experiences, we are withholding final judgment which, as Dr. Reed has pointed out, must come after all reports from all sources have come in.

One point should be made, and that is, throughout all continental Europe in all the larger clinical centers for some years past, long before it reached this country in its present furore, "twilight sleep" was given a thorough trial. Beginning in 1904, clinic after clinic from the Baltic to the Mediterranean has dropped it, until now there is left only the center of Freiburg and one or two smaller centers to keep the flame flickering. The most recent and really honest judgment came from Fried, in Switzerland, who sums it all up in these words: that he cannot see the advantage sufficient to justify the jeopardy in which it places both mother and child.

DR. BERTHA VAN HOOSEN: I am glad of the opportunity of hearing Dr. Reed's paper, for I am afraid I have become accustomed to the sentiments of the present speaker much more than the sentiments Dr. Reed has expressed. It is very encouraging to hear someone who has tried the Freiburg method, and who is not discouraged with what is known as painless childbirth. I know almost nothing of the Freiburg method, because we use at the Mary Thompson Hospital almost exclusively a fixed dosage, which is a much heavier or larger dosage than the Freiburg method. I think it is probably due to that that we have in all cases had what Dr. Reed did not seem to be able to get with the Freiburg method, absolutely painless childbirth, and we begin as soon as there is even a suggestion of labor. In practically no case, if we have time, do we wait until the pains are strong enough to annoy the patient.

The dosage that we use is one-eighth grain of morphine and one one-hundredth grain of scopolamine as an initial dose. In one hour one one-hundreth grain of scopolamine is given, and at the end of another hour another one one-hundredth grain is given. The patient is then under the anæsthetic, and after that time the room is dark or quiet, it makes very little difference to the patient. We keep the room dark and keep all persons from the room in which the patient is going under the anæsthetic, but after that time it matters very little if the curtains are up and people are talking even loudly or are in the room. They do not disturb the patient, and the patient does not recall what is going on. This dosage was determined and built up on the time that it takes to eliminate scopolamine-morphine from the system, and it has proved to be most satisfactory not only in the Mary Thompson Hospital, but also in the practice of many doctors outside who have taken up this method.

I had our superintendent give me a report this afternoon of the last 600 cases that we have had in the hospital. Of this number, 525 were "twilight," and 75 were "non-twilight." These 75 that were "non-twilight" were made up of patients who were brought into the hospital by doctors who are not on the staff who do not give "twilight," or a few patients who came in late and did not wish to have "twilight." In the 525 cases with "twilight" there was one maternal death, which occurred after the second convulsion. The patient was a nephritic, death occurred after the second convulsion, three hours after labor. Of the 75 "non-twilights," there was one maternal death due to an internal hæmorrhage four hours after delivery. In the 525 "twilights" there were 12 stillbirths; in the 75 "non-twilights" there were 13 stillbirths. Of the infants that died during the first or second week following birth in the 525 "twilights," there were 14. Of those who died during the first or second week that were "non-twilight," there were 2.

It may be of interest to know the cause of death of the stillbirths. There were 12 in the "twilight." Of the 12 stillborn, there were 2 macerated, 1 hydrocephalus, 5 premature, 3 syphilitic, and 1 not yet determined because microscopic work and postmortem have not been done. Of those who died

during the first and second week, 2 were hydrocephalic; 1 had a complete umbilical hernia, all abdominal contents being outside the body; 2 atresia of the œsophagus; 1 a congenital heart-lesion; 6 were premature; 1 had cerebral hæmorrhage; and 1 was hæmophilic.

The percentage of deaths among infants in the "twilights" in the 525 cases in less than Dr. Reed's, for counting those which were born dead, we have 2½ per cent; counting those that died afterward, we would have 5 per cent. Dr. Reed, I believe, had 8 per cent. While comparing "non-twilights," we had 20 per cent stillbirths, and 3 per cent died later.

To me, these figure emphatically demonstrate that the child has a much better chance to live during delivery under "twilight" than without it, when we had 20 per cent. If those 75 had "twilight," we would not have had 13 stillbirths. We probably would not have had any more than 2½ per cent stillbirths as we did under "twilight."

The doctor mentions the islands of pain. In this fixed dosage we entirely eliminate the islands of pain, and instead of having 85 per cent, we will have on an average 99 or 100 per cent of successful "twilights."

I feel I must say a word or two about the series of cases they had at the Michael Reese. I feel that every series of 100 will probably present entirely different results. We have here Dr. McCann, interne at the Mary Thompson Hospital, and she informs me that of a series of 50 cases there was not one unsuccessful. Dr. Conn, during her internship, had a series of 100 that were successful. She had a most unusual series — so unusual that I can remember her 100 cases very well. She had not had one forceps delivery in a hundred. She had not one hæmorrhage; she had not one stillbirth, and she had only seven tears. Four of the women were multiparæ, and three of these tears were in primiparæ. That was one continuous hundred. Dr. McCann's was another continuous hundred. She had one forceps, 2 lacerations that she had to repair, so I feel every hundred will represent some new and perhaps some special thing will be demonstrated. When you come to a series of 500, you have a great many different things illustrated, but one thing certainly must be brought out, and that is, where you have but 1 maternal death in a series of 500, where there had been placenta prævia and twins, and many cases of eclampsia (there were at least a dozen cases of eclampsia), contracted pelvis, and hydrocephalus, the results must be considered remarkable. We had very many complications, and when we had a series of 500 with one maternal death, and that due to eclampsia, I should have been much surprised if that patient had lived. When you have only 5 per cent mortality among the children, and that includes all of the peculiarly deformed children that were practically unfit to live, I feel that Dr. Baer ought to be willing, at least, to try two or three more hundred and see if he cannot get something as uniquely successful as his cases have been uniquely unsuccessful.

Dr. Charles B. Reed (closing): I have very little to say in closing the discussion. So far as my observation goes, the trouble is not with the Jewesses as such; but I think highly emotional as they are, they lack possibly the inhibition which other peoples equally emotional may possibly possess. I do not know that is so. I know that in our experience our violent disturbances all came with the Jewesses, and I feel with Dr. Baer that if his series was anything like the four I had, I would not want any set of internes or nurses to carry out the treatment.

As to dropping the treatment abroad, I think the war is ample excuse for that. The hospitals over there are being used very largely for the wounded from the front, and there is very little or no attention paid to the women.

I am very glad to learn from the Mary Thompson Hospital their results have been so favorable, and I trust they will continue so.

POST-OPERATIVE ILEUS

Dr. William M. Thompson read a paper entitled "Post-Operation Ileus" (see p. 688).

DISCUSSIONS

Dr. Channing W. Barrett: I have very little to add in regard to this paper. I read a paper upon this subject some years ago and I have had more experience with these cases than I wish to have. I will say this, that I had more experience with post-operative ileus during the time I was using scopolamine-morphine anæsthesia than before or after its use. Patients seem to have a more stormy time with their intestinal tracts after the use of that than at other times. I have had a number of patients recover when they were in a desperate condition, in which we did an enterostomy, draining, and later closing the fistula. I think we may look forward to the time when, in many instances, we can do an enterostomy to relieve the obstruction at the time, do nothing else, and have the patient recover the use of the bowels, after the inflammatory period has stopped, the fistula closing entirely of its own accord. I have had a number of cases of that kind.

THYMUS DEATH

Dr. Frederick Falls (by invitation) read a paper entitled "Thymus Death" (see p. 712).

DISCUSSION

Dr. Charles B. Reed: I would like to ask Dr. Falls how he makes percussion in these cases when the child is in the prone position?

Dr. Falls: The method of percussing the gland in the prone position is advised by Jacobi, but I have never seen Jacobi perform it. I should imagine it would be done best by having the child supported possibly by a second individual and simply percussing the gland in that way.

CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD FEBRUARY 4, 1916, WITH THE PRESIDENT, DR. SAMUEL C. PLUMMER, IN THE CHAIR

INTERMITTENT HYDROPS

DR. VICTOR L. SCHRAGER: This man is 25 years of age, and ever since he was 14 he has had periodic swellings of the knee. At the beginning, the knee would swell every two or three weeks, then he had periodic swellings four or five times a year. In June, 1913, he had a painful swelling which recurred twice in rapid succession. When I saw him I injected formalin and glycerin empirically, and ever since then a curious thing has happened, he has had recurring swellings every ten or twelve days. The symptom-complex is very definite. He knows a few hours before that his knee is going to swell. At first there is a sense of fullness and then within eight or ten hours the knee swells and remains swollen about forty-eight hours, during which time he has no pain but has a slight limp. The last time the knee was so swollen that he could not take his trousers off. I have aspirated this knee three times and found perfectly clear fluid, with no chemical or cellular constituents. There is no luetic, Neisserian, or any other type of infection. There is no focal infection of the teeth or the gums. There is no etiology. This case belongs to the class described as angioneurotic œdema.

SURGICAL REPAIR OF A STAB WOUND OF THE PERICARDIUM

DR. WILLIAM FULLER: The first case I desire to present is the one before you now. This man is an Irishman, 28 years old, strong and of athletic build. On the night of November 14, 1915, he had an encounter with another man and from him received three stab-wounds with an ordinary pocket knife; the blade of which measures two and a half inches in length.

One wound was just over the left kidney and the other over the outer side of the arm. Neither amounted to much, as both were superficial and required for their closure only a few skin stitches. The third wound which was at the junction of the left sixth rib with the sternum was a most serious one; the knife severed the rib at this point, opened the pleural cavity, collapsed the lung, and cut the pericardial sac open for the distance of about two inches.

This man walked some distance after the stabbing but fell finally, exhausted from the loss of blood. He was taken to a hospital and admitted to the service of Dr. C. F. P. Korssell. He was seen by us in a short time thereafter and his condition was as follows: The pulse was barely perceptible. The respirations were irregular and shallow. His skin was cold and clammy and presented a very pronounced pallor. When the patient was moved about or turned to one side, great streams of blood would spurt from the chest wound, and the inrush of air with respiratory acts, owing to a collapsed lung, was very noisy.

The patient's general condition was so extremely grave that further time was not lost in getting him to the operating table. He was hurriedly given a few whiffs of ether, and the chest was painted with iodine. Through a skin incision running out from the stab-wound to a point on the sixth rib some six inches away, the rib was resected and removed. Division of the intercostal muscles and parietal pleura disclosed the extent of the injury. The lung was only partially collapsed; the chest cavity contained many large clots and much free blood. The heart could be seen and felt beating feebly and irregularly, and showed the pericardial incision as mentioned, and also the pericardial sac distended with blood-clots. The pericardial cut occupied approximately a position on the left anterolateral surface of the heart and extended to within one inch of the apex.

Retraction of the fifth and the seventh ribs, the sixth being out, gave a good view of the damage done and also easy access of the heart. Two long forceps, one on either edge of the pericardial incision, held the heart in the chest opening and with a continuous catgut suture the pericardium, after emptying the sac of blood-clots, was tightly closed. This suture besides closing the rent in the pericardium completely checked all bleeding from the margins of the pericardial incision.

With the hand introduced through the opening in the chest-wall all clots were removed and the chest-cavity was carefully sponged out with large packs wrung out of normal saline solution. The opening in the thorax was now tightly closed by first approximating as closely as possible the parietal pleura, then the intercostal soft parts, and finally the skin. No drainage at any point was used.

During the operation which lasted about thirty minutes, the patient received normal saline solution subcutaneously and about as much as could be put under the skin over the pectoral regions. He was returned to bed in fully as good condition as when he was placed on the operating table. His condition for three days following was not good. The pulse ranged from 120 to 150, the temperature reached 102° F., and his skin showed the same pallor. The lung by the third day was completely expanded, although no effort was made at the operation to remove the air from the chest-cavity. At the end of this time the pulse diminished in frequency, the temperature fell to normal, and the patient's general condition was much improved. The stitches were all removed on the tenth day from wounds which had

not suppurated, and the man left the hospital at the end of the third week entirely recovered.

No one surgeon has had sufficient experience in this kind of surgical work to justify important opinions or statements as to the proper surgical procedure in all instances. The only law seems that of expediency, and what would prove good surgery in one instance, might not be as valuable in another instance. The literature shows that a large percentage of the cases die from infection, and from the infection which no doubt followed the efforts at drainage.

If one's experience is limited to a single case observations of some value are not impossible. In our case the collapsed lung seemed to be of distinct value: First it gave easy access to the heart and facilitated our efforts at repairing the pericardial injury. Secondly, it probably lessened hæmorrhage from the pericardial wound; at least this is a point emphasized by Matas, who has had more than the average experience with this kind of work.

It is questionable whether efforts should be made to expand the lung even at the close of the operation. The use of any differential apparatus is time-consuming, and again not always at hand. Aspiration of the chest-cavity might be accomplished at the concluding steps of the pleural closure, but it should not be forgotten that a collapsed lung will, without this, expand in a very short time.

Pleural and pericardial drainage at the time of surgical repair of stab-wounds, which of necessity are generally clean, seems contrary to accepted surgical principles today. If indications for drainage are in doubt during the repair of such wounds it would appear much safer to close the wounds without drainage, owing to the great danger in this step, and institute it later if the need of it arises.

BONE TRANSPLANT OF THE HAND; METACARPAL BONE

This young woman is 25 years of age. She is not of the vigorous type, but her personal history furnishes nothing that in any way relates to the condition about to be described.

Upon the prominence of the metacarpophalangeal joint of the little finger of the right hand, she had a small wart, which she attempted to destroy with caustics, now about one year ago. She succeeded in destroying the wart in the manner described, but produced at the same time an infection of the wound which soon invaded the joint mentioned, as well as the lower end of the metacarpal bone. During a period of several weeks following the infection the patient received the most appropriate treatment by her physician Dr. John E. Haskell. In addition to this treatment two or three efforts were made surgically to limit the infection and save the bone; curettement and drainage of the joint, with removal from time to time of necrosed pieces of bone availed little. The process continued until the entire metacarpal bone was necrosed and removed. Following this the wound healed promptly, but left a badly deformed hand; the hand was made much narrower than before, and the little finger assumed a position almost at a right angle to the other metacarpals, giving a most unsightly appearance.

To correct the deformity of the hand a transplant was suggested as a possible means of accomplishing this step. The patient returned to the hospital a few weeks later and the transplant was made in the following manner: The hand was opened through the old scar left after removal of the metacarpal. No Esmarch was used and all capillary bleeding or oozing into the wound or around the transplant after closing the wound was thus prevented. Before removing the tibial graft, the wound in the hand was packed tightly with sterile gauze wrung out of hot salt solution and wrapped with a sterile bandage. The graft was now removed from the tibial spine including periosteum and endosteum. The hand was now unwrapped and unpacked showing a wound absolutely free from bleeding. Into this wound in the hand the graft was placed and there anchored by two or three catgut sutures. The skin was closed with silkworm-gut, the hand dressed, placed on a splint and suspended. At the end of ten days the stitches were removed from a perfectly healed wound and the patient left the hospital.

At the end of about five weeks' time the new piece of bone had become solidly united to the proximal phalanx. It felt and otherwise appeared to be of the same length, size and shape, as when transplanted. If any changes whatever had then occurred, or have since occurred, the skiagrams which have been made every month since that time fail to disclose them.

In all seven skiagrams have been made representing the condition as it appeared from month to month. From the first one which I now show you the graft resembles in every detail the same piece of bone which came from the tibial spine. The second, the third, and on to the last skiagram show the same thing; no changes of any kind have taken place. This autogenous graft therefore has not proved osteogenetic or osteconductive; but remains there the same living piece of tibial spine that was placed in this young woman's hand now seven months ago.

There now remains only one step to complete the original aim to restore the symmetry and usefulness of this hand and that is an arthroplasty at the metacarpophalangeal joint. Before attempting this final step it was deemed wise to allow for the elapse of sufficient time for whatever changes might ultimately take place in the transplant.

There is some difference of opinion as to what takes place in transplanted bone. That it is often absorbed yet proves an important factor in the subsequent production of bone is probably true. Again it seems just as probable that under certain conditions a graft may live and remain as the final bone without any changes whatever. When an autogenous graft is placed in a locality where bone

is needed, and every provision made for immediate nourishment as was attempted in the case here reported, it seems reasonable to expect continued viability of the graft.

REFLEX ILEUS OF RENAL ORIGIN

DR. DANIEL N. EISENDRATH read a paper entitled "Reflex Ileus of Renal Origin" (see p. 698).

DISCUSSION

DR. ROY G. PIERCE (by invitation): I really did not expect to be called upon to discuss this paper, but the problem which Dr. Eisendrath has presented this evening is interesting from the standpoint of the physiologist, for the reason that it brings up the discussion of the mechanism of excitation and inhibition of smooth muscles. There is very little absolutely known concerning these processes. The chemical and physical control of these processes, which are so important in the body, are such that it is rather hard to formulate definite theories as to how they are brought about.

The splanchnic stimulation by the reflex pain can hardly explain the long-continued dilatation of the gut as described by Dr. Eisendrath, and in searching for an explanation for this long-continued dilatation of the gut I have thought of some experiments which Cassel and Œxell have conducted with reference to bivalve mollusks. If the bivalve mollusk closes its shell and keeps it closed, even though more than four pounds of pressure per square centimeter is exerted on the little mollusk to pull apart the shell, it will be found exceedingly difficult to open the shell. The mollusk will keep its shell closed from twenty-four to thirty-hours. If you catch a mollusk as it is closing its shell with a piece of wood it will grasp the piece of wood tightly, and if you wedge the piece of wood out of the shell the latter will remain just half open, just as when you take an object out of a vice. If you push it together it will close, but you can easily open it to that point and it will not close until you stimulate the nerve of the adductor muscle.

I do not know whether it is interesting to you or not, but there are muscles which control this action in the case of the bivalve mollusk. There is a strong adductor muscle which produces this closing of the shell and there is besides, a smaller muscle which keeps it closed when once it is closed, and if you cut the nerve of the strong adductor muscle when the valves are closed, it makes no difference, the small muscle has caught the shell in that position and keeps it in that position. However, if you also cut the nerve of the small muscle the valve can be easily opened. If you stimulate the nerve going to the central ganglion the small muscle will contract and hold the shell together.

In this example it seems to have a mechanism by which we can explain something of the tonus of visceral muscles. It is a theory because we can conceive of viscera being held by the inhibitory excitory nerves midway between excitation and inhibition, that is, in a state of tone, just as we know muscles and viscera are held, because we can remove viscera from the body and do not get extreme dilatation of the gut, so we can conceive of this state of tone being due to some mechanism like that which holds the shell together without the expenditure of anything. The bivalve mollusk does not extend its energy when it holds the shell together in that way. It holds it without the expenditure of any energy. The amount of oxygen which the mollusk takes up during the same given time is unchanged. So it means its muscle is cut and it is independent of any excitory nerve mechanism.

It seems to me that due to the long-continued dilatation of the gut, we may be able to explain in the same way the splanchnic excitation in reflex ileus. We have produced a state of fixation of the gut in the dilated position, the gut is held in that dilated position, and it is only by a sort of gut mechanism, as in the bivalve mollusk, that ileus is brought about. It takes a strong excitory process to cause the gut to assume its tone.

DR. DONALD MACRAE, Council Bluffs, Iowa: I have not seen any case of exactly the type Dr. Eisendrath speaks of, but in so far as the kidney stone is concerned I have seen several cases. I have in mind two cases in boys which occurred quite recently following injuries. One was the result of a horse kick in the back and the other was due to a fall, the boy jumping from one stall to the other, falling and striking on his right side upon a board. Both of these cases occurred some distance from my town, and I was called several days later to operate for general peritonitis. That was the diagnosis given over the phone. The abdomen was immensely distended. There was no evidence of peristaltic action. In both cases apparently the ileus was marked. The kidney was not seriously thought of at that time. On careful examination it was evident there was bulging in both cases. They were both opened through a lumbar incision, and a large amount of urine, blood, and broken-down kidney substance came away, shortly after which the ileus disappeared.

I have seen ileus result from a twisted pedicle in cases of gangrenous ovarian cyst. These cases were diagnosed as ileus or obstruction of some character without any inflammatory condition whatsoever, and shortly after the removal of the cyst the symptoms of obstruction disappeared. I cannot conceive of that being the result of an inflammatory or infectious process, but rather to be determined along the line spoken of by Dr. Eisendrath.

DR. ARTHUR DEAN BEVAN: For years one of the common recognized causes of ileus has been gallstone colic and kidney colic. I have seen a number of cases of ileus in kidney colic cases. Some of them have been rather interesting from the standpoint of mistakes in diagnosis, in that they have been handled as cases of acute indigestion, with very marked abdominal symptoms, vomiting, distention, which were relieved within twenty-four to thirty-six

or forty-eight hours after opening the belly. These cases have been classified as typical abdominal cases involving the stomach and intestines, but later the cases were definitely cleared up by the demonstration and removal of a stone from the kidney.

I do not question the explanations that are offered by Dr. Eisendrath and Dr. Pierce, and yet we may be perfectly sure, when we think for a moment about the facts as they are presented in these cases, that the explanation, after all, is not a very simple one. If it was merely a reflex irritation, why should we not have constantly in every case of gall-stone colic, in every case of kidney colic, more or less evidence of this condition of paralytic ileus? We all know of dozens of cases of kidney colic without any abdominal symptoms at all, without any evidence whatever of paralysis. The explanation has not as yet been found.

I would like to emphasize the importance of this subject and to place on record one case in which the result of paralytic ileus was fatal. A man, who was operated on five years ago at the Presbyterian Hospital for kidney stones, died in about seven or eight days thereafter of paralytic ileus, emphasized and expressed especially as gastric ileus, as an acute dilatation of the stomach without any peritonitis, without any involvement of the peritoneal cavity. It was apparently one of those extreme cases of ileus without peritonitis following a kidney stone operation.

DR. E. C. RIEBEL: I would like to ask Dr. Eisendrath, if, in the post-mortem examination on the third case of hæmorrhage into the kidney, he examined the lining of the bowel, and if so, whether there were any changes in the mucosa of the intestine due to the distention?

DR. DANIEL N. EISENDRATH (closing): In reply to Dr. Riebel, at the autopsy there was no examination made of the intestines; I only secured permission to examine the kidney.

Dr. L. A. Greensfelder, my colleague at the Michael Reese Hospital, gave me permission to include in my paper a case which resembles very closely one of the cases Dr. MacRae spoke of. The patient was a boy, who was sent in with a diagnosis of ileus following a fall upon the loin. His abdomen was greatly distended; he was vomiting; he had all the classical symptoms of that condition, but when the abdomen was opened and the retroperitoneal tissues were found to contain a large amount of blood for the ileus symptoms it was immediately suspected there was some other cause. A rupture of the kidney was found and the kidney removed.

The whole clinical picture of that case was one of ileus, completely overshadowing the symptoms of injury of the kidney.

I feel as Dr. Bevan does that we cannot explain all these cases upon the reflex theory because we know there is a variation. But judging from the work of Cannon on adrenalin, we will have to accept this as a working hypothesis for the present.

DR. A. J. OCHSNER read a paper entitled "Surgery of the Colon," which was illustrated by slides.

DR. WILLIAM C. MACCARTY, Rochester, Minnesota, read a paper (by invitation) entitled "A Biological Conception of the Evolution of Carcinoma Based on a Study of Breast Cancer."

CORRESPONDENCE

ANTERIOR TRANSPERITONEAL HYSTEROTOMY

To the Editor: The article entitled "Anterior Transperitoneal Hysterotomy," by Dr. John B. Deaver, in the April issue of SURGERY, GYNECOLOGY AND OBSTETRICS, should not be passed over in silence. Its distinguished author advocates the use of transperitoneal hysterotomy, because he has "been doing it for years with no mortality and with the satisfaction of knowing that certain obscure conditions have been found and eliminated by early and radical means, which by the more conservative methods now in vogue, would have failed both of early diagnosis and proper treatment."

The author's thesis is based upon a series of 64 cases. The material may be divided into two classes; gynecological and obstetrical. Under the first grouping we would place:

1. Eight cases of symmetrical myomatous enlargements of the uterus. They represent simple myomectomies, in which the operator was not sure of his diagnosis until he had incised the tumor. In the ordinary and generally accepted sense, such cases are not classified as hysterotomy in the literature. Two cases of myoma and pregnancy are noted (three simple myoma of pregnant uterus are mentioned in the table), in which "the fœtus was sacrificed" (no mention of the age of the fœtus). From the data on hand, it is impossible to judge whether some operators would not have tried conservative myomectomy if they had opened the abdomen. *No mention is made of the indications for which these operation were performed,* although it is well recognized that fibroids rarely disturb the course of pregnancy or labor.

2. "Twenty-one cases were operated on because of bleeding which aroused suspicion of malignant disease of the interior of the uterus." Of the 21 cases *upon whom a laparotomy was performed,* 2, or less than 10 per cent had malignant conditions, warranting the risk of such extensive operation; 1 chorio-epithelioma, 1 early corpus carcinoma. Ten cases showed "retained products of conception," 3 cases "benign polyp of the endometrium," and 6 cases "chronic hyperplastic endometrium." Although the author states that the majority of these cases had been curetted one or more times without relief prior to the operation, he does not mention whether the curettage was performed by himself or other competent surgeon, or whether the scrapings had been subjected to microscopical examination. Furthermore, he leaves us in doubt as to whether the *transperitoneal curettages* which he performed benefited "the chronic hyperplastic endometritis" cases permanently.

Turning now to the obstetric conditions described (31 in number), he says: "Three children lived, the remainder all being under six months and nonviable." This represents a fœtal mortality of 90.3 per cent.

1. Placenta prævia, 10 cases: average duration of pregnancy 4 to 7 months; maternal mortality nil, fœtal 43 per cent. Just how many children out of ten cases survived, *so as to give 43 per cent fœtal mortality,* is not clear. In one case, at least transperitoneal hysterotomy was performed *for placenta prævia (!) at the third month.* Does this need further comment?

2. No details are given regarding the three cases of toxæmia of pregnancy and two cases of toxæmia of pregnancy and eclampsia, although the mortality statistics of various clinics are given *in extenso.* No mention is made of immediate induction of labor by the metreurynter, although the dangers of "immediate manual and instrumental dilatation of the cervix" are emphasized in contradistinction to the harmlessness of hysterotomy.

3. "Ten cases of premature separation of the placenta, suspected of placenta prævia" are noted. *The duration of the hæmorrhage averaged seven weeks(!),* the course of the pregnancies averaged only four months, only one of the ten being over five months. In *seven of the ten cases the operator also performed appendectomy.* Does this description in any way correspond to the dreaded premature separation of the placenta near or at term, known to the obstetrician, or should this group be included in the author's classification of "one of the abnormalities of childbirth, producing a large maternal and fœtal mortality?" The writer sees no reason to classify these ten cases other than as *impending or inevitable abortions,* the fœtus being dead, the placenta being either completely detached, or in process of separation.

4. The complete absence of data in the cases of "severe renal infection during pregnancy, *amounting almost to sepsis*" (the italics are ours) prevents any attempt at analysis, but why laparotomy should be preferred to induction of labor or abortion is not stated.

While we do not doubt the fact that "in experiments on guinea pigs carried on at the Lying-in

Hospital in New York, it was found that, after opening and carefully suturing the uterus, the scar was very difficult to find on microscopic examination" we would like to know how these experiments can be transferred without critique to the human being, so as to substantiate the preceding statement that "there is no danger in future pregnancies. if you cut well, and sew well . . . ."

Dr. Deaver is to be congratulated that his series of 64 hysterotomies show no maternal death or no serious post-operative accidents. Should less experienced surgeons follow his advice, and for instance perform laparotomy 21 times for bleeding from the uterus, suspicious of malignancy, their results might not bear as strict a scrutiny. To advocate hysterotomy in various types of threatened, impending, or inevitable abortion (for most of the cases of prævia and premature detachment of the placenta in the early months are classifiable in these clinical groups) is shocking to the gynecologist and obstetrician, who in far greater series restores these patients to health by conservative measures, such as simple observation, packing of the cervix, insertion of a bag, or, in the early months, by curettage.

"Blind scraping of the inside through the cervix with a sharp curette is one of the most pernicious practices in medicine." Agreed to, and endorsed! But is blind opening of the abdomen, and then emptying or scraping to be more highly recommended to the profession?

New York. ROBERT T. FRANK.

The above letter was submitted to Dr. Deaver, who replies as follows:

To the Editor: It is not surprising to me, having lived through the period of opposition to every seemingly radical though salutary measure introduced into abdominal surgery, to meet with criticism of my extension of the field of transperitoneal hysterotomy to deal with conditions not already recognized as warranting it. I note with approval, however, that the chorus is decidedly less vociferous than was the case when the operation for its now classical indications was first advocated.

As for the carping at cases which *after operation* did not show a lesion necessitating hysterotomy I can only say that in the article in question it is distinctly stated that "I acknowledge that at times conditions are found which could be relieved from below."

The fact that in many thousands of operations upon the pelvic organs during the past few years but a small number of hysterotomies have been done for these conditions is an evidence of the care with which selection has been made. I presume that the willingness to criticise these recurrences arises from the fact that the obstetrician and gynecologist after his punctilio of "simple observations, puckering of the cervix, invertion of a bag or . . . curettage" can look back upon an unbroken series of correct diagnoses, early radical intervention where necessary, none where it is not necessary, and uneventful recoveries. It is because after many years' experience with these and like measures that I have not met with like success that I have adopted what is apparently a more radical measure in selected cases regarded by me as too grave in their potentialities to admit of watchful waiting or of measures that may prove to be less than sufficient. In a dangerous road I prefer to travel by light rather than by darkness. And it is because of the satisfaction I have had in so doing that I feel gratified in bringing this operation not to the attention of every cross-road surgeon who may perform it for insufficient indications, but to the attention of the experienced abdominal surgeon who will use it in emergencies and when in legitimate doubt of how to proceed.

My conception of the surgeon's duty is more and more that of one who is concerned chiefly with the prevention of mortality and the greatest amount of morbidity. The results of this operation in my experience have disposed of the former fears and I am not so much interested in criticisms that display nothing but a bias in favor of one method of accomplishing the same result in less important conditions as I am pleased with the opportunity of interrupting the course of malignant disease at the earliest possible moment or delivering a woman promptly and safely from the perils of infection, hæmorrhage, or toxæmia.

JOHN B. DEAVER.

Philadelphia.

NOTE. For the benefit of Dr. Frank and his obstetric and gynecologic colleagues I may add that since writing my paper I have done 15 hysterotomies, making a total of 79 without mortality. The average stay in the hospital of these patients has been fourteen days.